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CIVIL ENGINEERING

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Turning Over a Cut, Indiana Limestone Quarry
The Steam Channeling Machines Are Mounted on Tracks to Facilitate Movement

Volume 5

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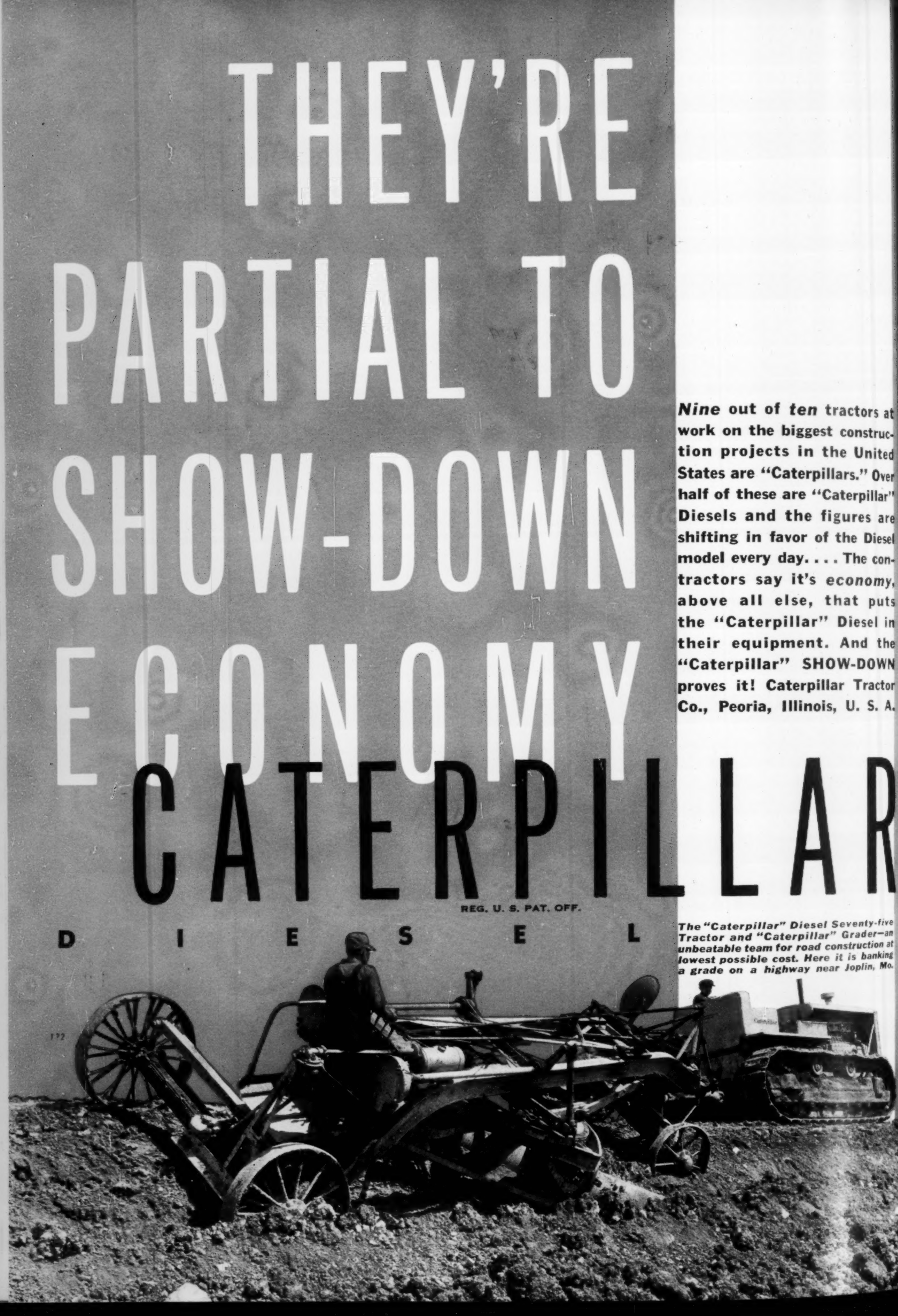

THEY'RE PARTIAL TO SHOW-DOWN ECONOMY

Nine **out of** ***ten*** **tractors at work on the biggest construction projects in the United States are "Caterpillars." Over half of these are "Caterpillar" Diesels and the figures are shifting in favor of the Diesel model every day. . . . The contractors say it's** ***economy,*** **above all else, that puts the "Caterpillar" Diesel in their equipment. And the "Caterpillar" SHOW-DOWN proves it! Caterpillar Tractor Co., Peoria, Illinois, U. S. A.**

CATERPILLAR

REG. U. S. PAT. OFF.

DIESEL

The "Caterpillar" Diesel Seventy-five Tractor and "Caterpillar" Grader—an unbeatable team for road construction at lowest possible cost. Here it is banking a grade on a highway near Joplin, Mo.

Among Our Writers

Lytle Brown holds degrees of bachelor of engineering, 1893, and civil engineering, 1894, from Vanderbilt University, and that of doctor of engineering, 1931, from Michigan State College of Mines. He is a graduate of the U. S. Military Academy at West Point, became chief of engineers in 1929, and was made a major general in 1935. Four articles dealing with the various phases of the work of the Engineers Corps, written by General Brown, have already been published in Civil Engineering.

Paul V. McHenry has been employed by the consulting firm of Modjeski, Masters, and Case, Inc., since graduating from college in 1927. He was engaged on the preparation of plans and on field work for various highway bridges in Philadelphia, Pa., and Washington, D.C., and on the bridge across the Mississippi at Davenport, Ia. It was while inspecting the preparation of stone for bridge use that Mr. McHenry acquired the detailed knowledge of quarrying and fabricating limestone which is here presented.

Herbert M. Knight had long experience in construction work, from division engineer for municipalities to contracting engineer and contractor, before entering the employ of the Maryland Casualty Company in 1922 as engineer of that company's New York office. Mr. Knight's familiarity with the problems of contracting work, from the point of view of the engineer and contractor on the one hand and from that of the surety company on the other, makes his comments on the various aspects of bonding of particular value.

Harland Bartholomew, of Harland Bartholomew and Associates, city planners, St. Louis, Mo., has prepared comprehensive city plans and zoning ordinances for a large number of American cities. At the present time he is engineer of the St. Louis City Planning Commission, and consultant for the Missouri State Planning Board. Mr. Bartholomew's present paper draws for examples and illustrations upon conditions in many different cities throughout the country.

Magnus Gunderson is chief structural engineer for the architectural firm of Graham, Anderson, Probst, and White, Chicago. He is well qualified to present the descriptive article in this issue on the Field Building, on which we was in charge of both design and construction work.

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This Issue Contains

MAN'S WORK ADORNED—BY NATURE'S MAGIC TOUCH
(see page 664) 3

WATERWAYS IMPROVEMENTS IN THE UNITED STATES 613
Lytle Brown

SOME FACTS ABOUT LIMESTONE 618
Paul V. McHenry

WHAT IS SURETYSHIP? 623
Herbert M. Knight

OFFICIAL CITY PLANS ATTAIN NEW IMPORTANCE 626
Harland Bartholomew

DESIGN OF THE FIELD BUILDING, CHICAGO 631
Magnus Gundersen

ENGINEERS' NOTEBOOK

Models Illustrate Work of Soil-Mass in Foundations 636
N. M. Gersevanov

Diagram for Determining Maximum Deflections of Continuous Girders 637
Jerome W. Howe

OUR READERS SAY 638
PROGRAM FOR FALL MEETING 644
SOCIETY AFFAIRS 650
ITEMS OF INTEREST 664
NEWS OF ENGINEERS 666
CHANGES IN MEMBERSHIP GRADES 667
APPLICATIONS FOR ADMISSION OR TRANSFER 669
MEN AVAILABLE 672
RECENT BOOKS 8
CURRENT PERIODICAL LITERATURE 10, 12, 14
INDEX TO ADVERTISERS, INDUSTRIAL AND ALPHABETICAL 18, 20, 22, 24

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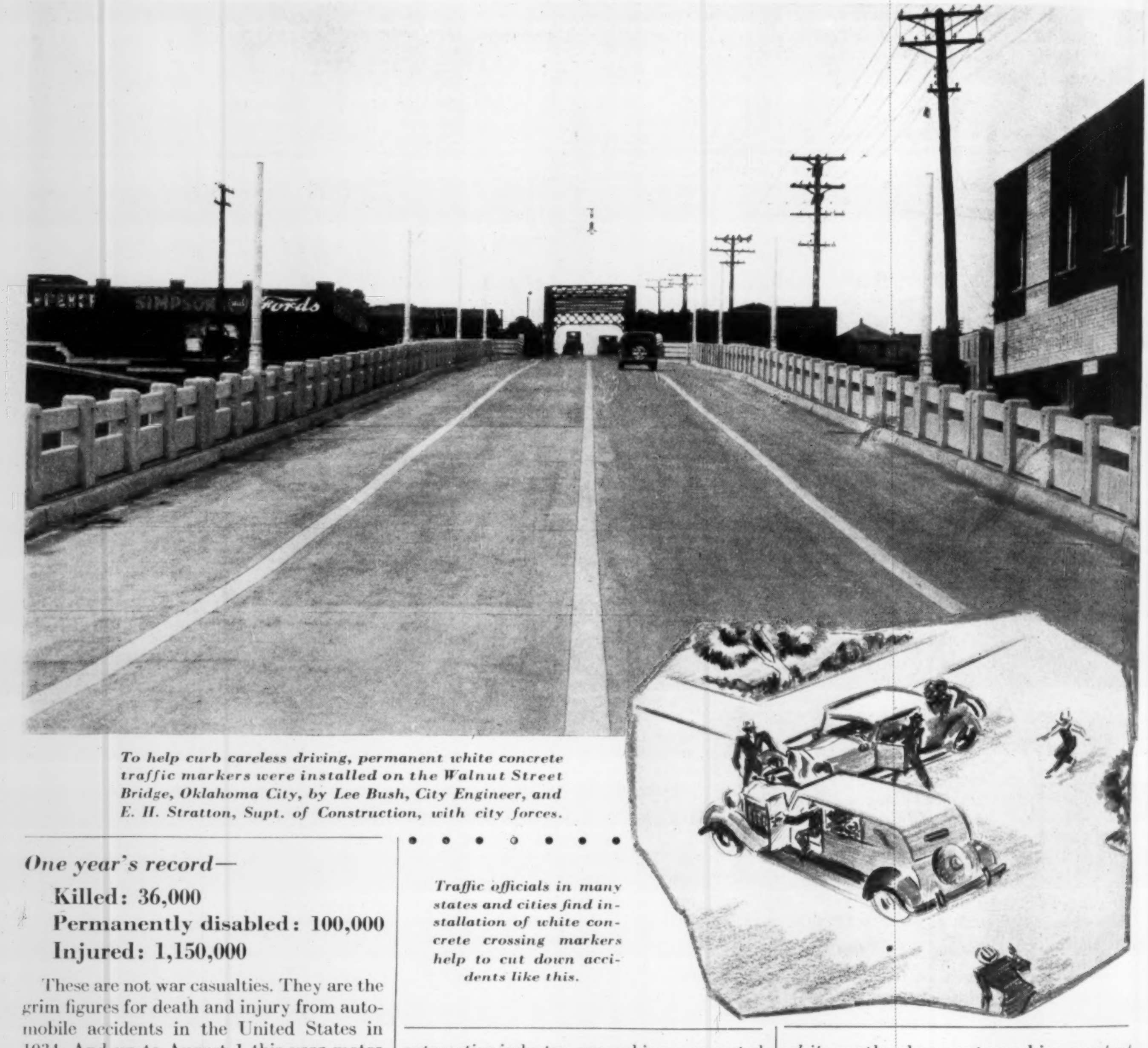
WHITE CONCRETE TRAFFIC MARKERS AID IN DRIVE FOR TRAFFIC SAFETY



To help curb careless driving, permanent white concrete traffic markers were installed on the Walnut Street Bridge, Oklahoma City, by Lee Bush, City Engineer, and E. H. Stratton, Supt. of Construction, with city forces.

Traffic officials in many states and cities find installation of white concrete crossing markers help to cut down accidents like this.

One year's record—

Killed: 36,000
Permanently disabled: 100,000
Injured: 1,150,000

These are not war casualties. They are the grim figures for death and injury from automobile accidents in the United States in 1934. And up to August 1 this year motor cars have killed another 18,000 and have injured 35 times that many men, women and children in this country.

What can be done? Three things, says the National Safety Council: 1. Educate drivers and pedestrians to safety. 2. Keep vehicles in good condition. 3. Improve our streets and highways safety-wise.

In every part of the country, highway and traffic officials, as well as members of the automotive industry, are making a concerted drive to carry out this 3-point safety program—determined to batter down the steadily rising curve of death and injury.

No one means, of course, can be singled out as a cure-all. But in the drive to build greater safety into streets and highways (point 3 in the program) there is one thing which officials have found helpful—permanent white concrete traffic markers.

These white concrete markers, made with *white* portland cement, combine *constant* visibility (and hence greater safety) with economy. They are not surface markers, but are built *into* the pavement—asphalt, brick or concrete. They can't be worn away. They never fade out. They never need replacement. They are *always* white—*always* easy to see. Write for complete information to Universal Atlas Cement Co. (United States Steel Corporation Subsidiary), 208 South La Salle Street, Chicago.

189

Help Build Safety into Streets and Highways with

ATLAS WHITE TRAFFIC MARKERS

Made with Atlas White Portland Cement—Plain and Waterproofed

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VOLUME 5

CIVIL ENGINEERING

OCTOBER 1935

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NUMBER 10

Waterways Improvements in the United States

Reviewing Some of the Major Governmental Activities in Connection with Rivers and Harbors

By LYTLE BROWN
MEMBER AMERICAN SOCIETY OF CIVIL ENGINEERS
MAJOR GENERAL, U. S. ARMY, COMMANDING ATLANTIC SECTOR, PANAMA CANAL DEPARTMENT, FORT DE LESSEPS, CANAL ZONE

IT is of considerable interest to note the tremendous strides made in waterways improvement by the government, especially since the Civil War. While only attempting to emphasize the high lights of this work, General Brown has here given a wealth of information covering the accomplishments on our numerous rivers, on the Great Lakes, and on harbors on all coasts. He deals particularly with the work on the Mississippi River system, both for navigation and for flood protection. As a background for this paper readers may wish to consult the companion article by the same author in the August issue, describing the development of general policies and procedures governing river and harbor work done throughout the country by the U. S. Corps of Engineers. Both articles have been abstracted from remarks made by General Brown on December 10, 1934, before a meeting of the Panama Section of the Society.

THERE is one great river system in the United States—the Mississippi. This has three principal branches: The Upper Mississippi or that part above St. Louis; the Ohio, extending to Pittsburgh, where its two branches, the Allegheny and the Monongahela unite; and the Missouri, extending from the Upper Mississippi near St. Louis to the Rocky Mountains far in the Northwest, in Montana.

In its entirety, the Mississippi valley includes nearly half of the territory of the United States, the bulk of the farm lands and natural resources as well as a large part of the population. Navigation on its streams has been and still is an important factor in the development of the entire country. It played a large part in the result of the Civil War, a much larger part than is generally recognized. The improvement of navigation on it has been urged on the federal government for over a hundred years, or ever since the first steamboats were launched on the Ohio.

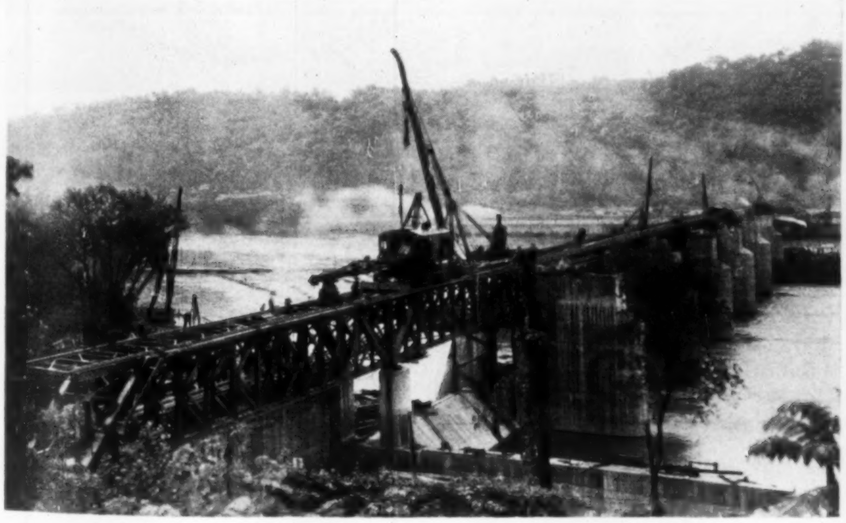
STEPS IN IMPROVING THE OHIO

The Ohio taps the coal and oil fields of Pennsylvania, West Virginia, Ohio, Kentucky, Illinois, and Tennessee. Its valley is a workshop that challenges any other in the world, and the course of the stream is the pathway to the West and Southwest from the thickly populated Northeast, and even from Europe.

Not until 1907 was the first systematic and adequate improvement of the Ohio River approved. This work, giving a 9-ft depth at the lowest stages from Pittsburgh to Cairo, was finished in 1929. In its natural condition the river contained many bars, over which the depth at low water was not more than about 3 ft and even then in winding, non-navigable channels.

Some time before this work on the Ohio was completed, the Monongahela from Pittsburgh well back into the coal fields had been improved for a minimum draft of about 7 ft. This improvement greatly benefited the iron and steel industry at Pittsburgh and the coal industry of the Monongahela district.

In the old days, when the burden of improvement was borne by state and private enterprise, other tributaries of the Ohio were improved—among them the Muskingam, the Kentucky, and the Green rivers. A canal was built around the falls of the Ohio at Louisville by private enterprise some twenty-five years before the Civil War. These works were later taken over by the federal government and added to. The Cumberland has been canalized from its mouth to above Nashville for



MONTGOMERY ISLAND DAM ON THE OHIO RIVER NEAR BEAVER, PA.
General View Looking Toward the Lock

a minimum draft of 6 ft, and similar work is in progress on the Tennessee to give a 9-ft depth from the mouth to Knoxville. Muscle Shoals has always been a barrier to navigation on the Tennessee. Work there will put more than 9 ft of water over the shoals.

PLANS DEVELOPED FOR THE MISSISSIPPI

On the Mississippi, above the mouth of the Ohio to St. Louis, a low-water channel 9 ft deep has been maintained with much difficulty and expense. Contraction works and dredging have been the means used. Above St. Louis and as far as Minneapolis, for a long time there has been an effort to maintain a low-water channel of 6 ft by the same means. During the last few years a plan to secure a 9-ft minimum depth by locks and dams in this reach has been adopted and is now in process of execution.

GENERAL VIEW OF DAM NO. 3, ON THE ALLEGHENY RIVER
This Dam and Lock Are near Oakmont, Pa., About 14 Miles Northeast of Pittsburgh

Much money has been expended in an effort to provide a minimum depth of 6 ft in the Missouri from its mouth to Sioux City. This depth has been secured to Kansas City, four hundred miles from the mouth, and work is in progress on the 400-mile reach between Kansas City and Sioux City.

Experience from 1929 to 1934 indicates that the maintenance of a navigable channel in the Missouri is scarcely practicable in such dry years, with only the natural flow of the river, which is diminished greatly by the run-of-the-river irrigation works on the tributaries from the west. This fact, together with some considerations of flood protection and the generation of power, has caused the adoption of a plan for a vast storage dam on the Missouri, above the mouth of the Yellowstone, which will hold back some 20 million acre-feet for release in low-water seasons.

This Fort Peck earth dam is the most ambitious structure of its type that I know of anywhere. It will be considerably longer than Gatun Dam on the Panama Canal and about three times as high. The storage is of comparatively low cost as compared with other possible reservoir sites in the United States at present, that is, about $5 per acre-ft or less. The flow of the river during construction will be taken care of by tunnels through the adjacent bluffs. The site, above the mouth of the Yellowstone, avoids much of the silt that the Missouri normally carries below that point. It is probable that this dam can be justified on the basis of combined benefits to navigation, power, flood protection, and irrigation. Its contribution to low-water flow will be felt certainly as far as the mouth of the Ohio and therefore should remove some of the opposition to the St. Lawrence waterway treaty as it now stands—restricting the amount of water that the United States can take out of Lake Michigan via the Illinois waterway.

The Illinois waterway provides a connecting link between the Mississippi system and the Great Lakes system, via the Illinois and Des Plains rivers. The City of Chicago has spent about $70,000,000 on that part between Lake Michigan and the Illinois, and the State of Illinois has spent about $20,000,000 on the Illinois. It was necessary for the United States to complete this work at a cost of some $10,000,000. The depth is 9 ft and the width is ample. In finishing the work much trouble was experienced with both railway and highway bridges of an obstructive nature. All existing street bridges at Joliet had to be removed and remodeled. This waterway affords a connection with both Chicago and Calumet harbors on Lake Michigan, although due to obstructive bridges the usefulness of the channel is restricted.

Below the mouth of the Ohio the Mississippi is improved for navigation to a minimum depth of 9 ft. The means used have been contraction works and dredging, particularly the latter. The dredge cuts are principally for the purpose of securing concentrated action by the river itself. Most of the work for navigation has been done between the mouths of the Ohio and the Arkansas. Below the Arkansas there is little need for such work, except at the mouth, for in this reach the Mississippi is a deep alluvial stream of great power. Sea-going vessels ascend to Baton Rouge, the first high ground above the mouth.

FLOOD CONTROL ON THE MISSISSIPPI A GIGANTIC PROBLEM

On the lower Mississippi, there is another great river problem closely associated with navigation, and that is flood control. In the early days the great river overflowed annually about 30,000 sq miles of territory. This was rich land particularly adapted to the growing of cotton. As the value of the land increased, the local planters began to build levees. At first, since the protected land was of small extent and the river had room to expand, the levees did not have to be high. The original ones at New Orleans were thrown up by hand. I suppose they were not more than waist high in the beginning. But as more and more land was protected and the river was more and more confined, the flood plane was raised and the levees had to be built higher. There are no data to support the idea that the bottom of the channel has been raised. Private owners could not meet the

LEVEE CONSTRUCTION ON THE MISSISSIPPI NEAR MOUNDS, LA.
The Large Drag-Line, with 10-Yd Bucket on a 150-Ft Boom, Casts Fill Directly Into the Levee Without Rehandling

demand along their river fronts. Levee districts had to be organized both to raise the necessary funds and to coordinate and administer the work. Then states took control over the levee districts and one side of the river was embattled against the other. So the problem had to be assumed by the United States, because of its close association with that of works for navigation and of the conflicting interest of states. At present there are coordinated efforts by states, levee districts, and the federal government, with a persistent effort on the part of local authorities to put the entire burden of expense on the central government.

The present plan for flood control on the lower Mississippi has two phases: the building of better and higher levees designed to withstand any ordinary flood; and for times of extraordinary flood, when the river, if confined, would overtop the levee system, the provision of openings in the levee system to allow the flood waters to escape to the sea by routes outside the system. The problem is not difficult from a strictly engineering standpoint, but it is very difficult from an economic and psychological standpoint. It is hard to decide how much ought to be done or is worth doing, and what procedure is the least costly. A serious problem has been raised by the decision to allow waters that cannot be confined by a reasonable levee system to escape by a separate route to the sea. Those whose lands comprise the separate route want some other route chosen, or they want very high damages—as much as they can get, of course.

It seems practicable to confine the greatest probable floods between levee lines as far south as the mouth of the Arkansas, although the largest contribution of flood water comes from the Ohio. The floods from the great Missouri basin do not synchronize with those from the Ohio for two reasons, the distance and the origin of the water—that from the Missouri being made up largely of melted snow. Similarly, but to a less extent, there are features which prevent the flood waters of the upper Mississippi from arriving to magnify the Ohio crest. The slope of the Mississippi between the Ohio and the Arkansas is considerably steeper than below the Arkansas. Other things being equal, the rapidity of discharge is greater where the slope is greater. Furthermore, the Arkansas basin is very large and is subject to torrential rainfall. Floods may be frequent and it is quite probable that they will synchronize with those from the Ohio. From these reasons it may be readily understood why it is very difficult, if not impracticable, to contain Mississippi flood waters within the main levees south of the mouth of the Arkansas.

Driving Piles for Dike Construction, Missouri River
View at Apoe Bend, near Nebraska City, Neb.

Any levee system has its limitations. If carried to extremes levees become absurd. Rain falling on a territory must get into the streams to be carried away. The drainage of the country must be provided for, and the levee system has to take that into account. No levee system can be so constructed that it forms large pockets in which the drainage from extensive areas is trapped. Pumping on a large scale is very expensive; the land must be of the greatest value to warrant it. For this reason in the lower Mississippi valley large areas around the mouths of the Arkansas, the Yazoo, and the Red rivers are not protected from backwater flooding by the levee system. The flood-control plan does not contemplate the protection of these areas completely at present. It does contemplate lowering of the backwater level and reduction of flooded areas in emergencies by allowing water to escape to the sea through two routes outside the main channel south of the Arkansas.

Straightening the Channel, Texas Intracoastal Waterway
Scene at Mud Bayou, near High Island, Tex

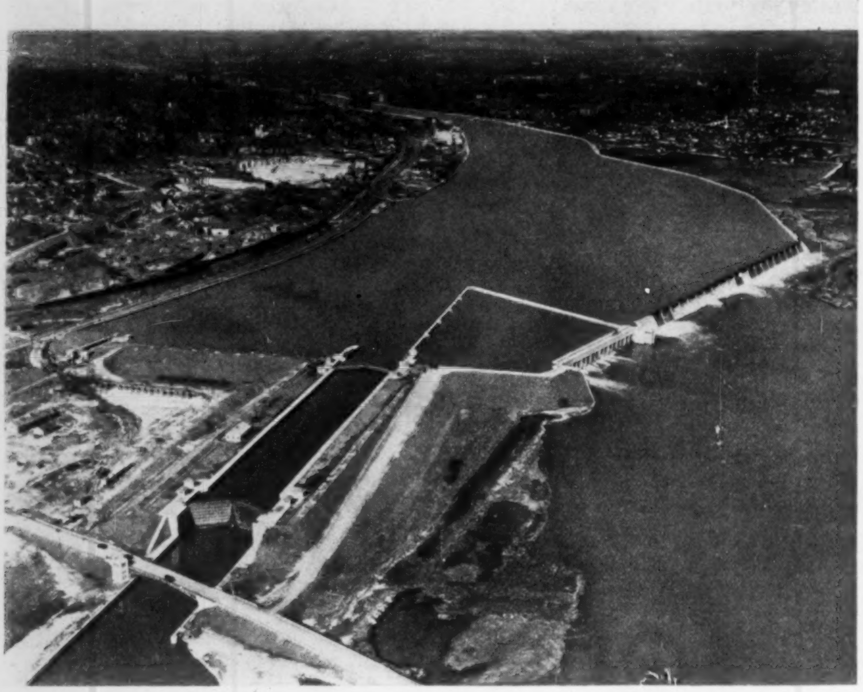
MEASUREMENTS DISCLOSE MAGNITUDE OF FLOODS

To give an idea of the immense amount of water that must be disposed of on the lower Mississippi in time of a great flood I shall give figures based on measurements of flood waters since 1850, on recorded gage heights of water marks over a longer period, on records of rainfall and runoff on the watershed during the life of the Weather Bureau, and on the probability estimates. The probable greatest flood is based on a period of 200 years. Such a flood is somewhat greater than the greatest of record, that of 1927, which was brought by the coincidence of discharges from the Ohio and the Arkansas.

Such a maximum probable flood will require the discharge, at the latitude of the mouth of the Red River, of about 3,000,000 cu ft per sec. Yet the leveed channel at New Orleans will safely carry only about 1,250,000 cu ft per sec. There will remain then about 1,750,000 cu ft per sec which the leveed channel will not carry. It is proposed to allow 1,500,000 cu ft per sec to escape to the sea at Morgan City, La., through the Boeuf and Atchafalaya basins, by taking water out just below the mouth of the Arkansas into the Boeuf Basin, and additional water out at the mouth of the Red, all to pass through the Atchafalaya Basin. This water is to be confined by side levees as much as is practicable, thus saving lands from the general spread of water west of the main stream and south of the Arkansas. This will leave 1,500,000 cu ft per sec in the Mississippi below the mouth of the Red River going on toward New Orleans. Of this, 250,000 cu ft per sec must be taken out before it reaches New Orleans, through the controlled outlet at Bonnet Carré 17 miles above the city on the left bank.

The discharge is made into Lake Ponchartrain at sea level. This spillway is designed especially for the protection of New Orleans, since it is impracticable to raise the levees along the city waterfront, where the investment in wharves and docks is very great.

This plan, made under the direction of General Jadwin, Chief of Engineers, U. S. Army, in 1928, has been vigorously pressed under the law which required its completion by 1938 at an estimated cost of $330,000,000. The Bonnet Carré floodway has already been completed, and the levees along the main stream, along the south bank of the Arkansas, along the south bank of the Red, and in the Atchafalaya Basin will be completed during the current year. The levees in the Boeuf Basin are about the only part of the program that has not been touched, owing to the great controversy over the proposal to utilize it for flood waters in emergencies.



BRANDON ROAD DAM AND LOCK, DES PLAINES RIVER
The City of Joliet, Ill., Appears in the Distance

Much study and considerable experimentation have been carried out with a view to keeping flood waters out of the Boeuf Basin. In my opinion the question has not yet been decided definitely; and it probably will not be until a great flood comes.

RESERVOIRS—A POSSIBLE ADJUNCT

I know of no engineering project over which there has been so much controversy as over the flood problem of the lower Mississippi. Many wild schemes have been formulated, and the method adopted has been vociferously attacked. However, most of the agitation has come from those who were not well informed, were not in any responsible position, and had nothing in the way of reputation to lose.

One method has been much discussed—for nearly a hundred years, in fact. That is the method of storage reservoirs to hold back the surplus flood waters and release them in times of low flow. Proponents of this plan have many arguments in their favor. Floods will be controlled, power will be created, irrigation and water supply will be promoted, navigation will be benefited, and last but by no means least, federal money will be spent somewhere else than where it is being spent. In regard to all these benefits there is quite a welter of conflict. If the reservoirs are to be used for flood control, they must be emptied as quickly as practicable; if for distant flood control they must be emptied with such an end in view, and that is not likely to correspond with the time for local flood control. If they are to be used for power and irrigation they must be kept full as long as possible; if for navigation, they must be kept full until low water comes. There may be some harmony between navigation and power and irrigation uses, but flood control stands much alone in the reservoir uses.

But what staggers the engineer is the cost. It has been computed that reservoirs to store the water that must escape from the levee system now being built on the lower Mississippi would have a capacity of 200,000,000 acre-ft. A storage reservoir costing less than $10 per acre-ft is difficult to find anywhere in the United States. At that cost, if it can be met, and met in the localities where the storage is needed, the reservoirs required only to take care of the water that it is proposed to divert from the lower Mississippi, would cost a total of two billion dollars. How many additional reservoirs would be needed to make sure of catching the flood waters created by heavy rains over the vast territory involved is a matter of guesswork. But more, much more capacity than the total given here would certainly be essential, for very general protection would have to be provided over the entire valley of the Mississippi, or at any rate over the watersheds of the Ohio and Arkansas and other tributaries south of the Ohio.

OTHER RIVERS IMPROVED

Many streams flowing into the Atlantic, the Gulf, and the Pacific have been improved by the federal government during the past hundred years. To mention a few—the Hudson has been improved to Albany, making that city an ocean port; the Delaware to Trenton; the Potomac to Washington, permitting cruisers to go to the Navy Yard there; the James to Richmond, making that city also a seaport; the Cape Fear to a point well above Wilmington, N.C., providing a port with a 30-ft depth and giving a lesser depth well into the interior; the Savannah to Augusta, Ga., with a 30-ft depth as far as Savannah; and the Columbia, on which work is still under way, to the mouth of the Snake. A great many small projects too numerous to mention have been executed to give isolated localities the benefit of water transportation.

One of the most notable improvements in the country, if not in the world, has been in the connecting channels of the Great Lakes, providing 24 ft of water generally, and this in one section where in the old days only an Indian canoe could pass. These connecting channels are the St. Clair, the St. Mary's, the Detroit, and the Niagara rivers. The Canadian Government has surmounted Niagara Falls by the Welland Canal at a cost of over a hundred million dollars. These connecting channels of the Great Lakes accommodate over 60 million tons of freight per annum. It is principally low-grade freight—iron ore, coal, limestone, and an appreciable tonnage of wheat. One of the most tangible evidences of the recent depression that has come to my notice has been the great shrinkage of Lake tonnage.

HARBOR WORK ALSO ACCOMPLISHED

Improvement of the harbors of the United States has been so prosecuted as to keep fully abreast if not in advance of the needs of commerce. It has been in the highest degree economical and progressive, never lagging far behind needs, but never going to extremes in anticipating them. A remarkable thing about this work is that there is probably not a harbor in the United States, except at San Francisco, which in its natural state would accommodate modern shipping. Harbor work consists mainly in the construction of breakwaters, in dredging, and in regulating tidal currents by jetties and dikes. The development of the hydraulic pipe line and the seagoing hopper dredge, and the perfection of methods to excavate subaqueous rock have been the factors principally responsible for harbor development.

Beginning in New England, the progress made on the principal harbors will be reviewed. At Boston the original depth at the entrance and in the channels was probably not over 24 ft, and the channels were winding and narrow. Now Boston harbor has a 40-ft depth and channels 800 ft wide. Formerly the bar in front of New York harbor gave a clearance of about 23 ft and the main channels had a limited width of less than 1,000 ft. Now the depth at the entrance is 40 ft and the main channel is fairly straight and 2,000 ft wide. Deep-water anchorage areas and subsidiary channels have been provided by artificial means, which combined make New York the greatest port in the world.

At Philadelphia, a vast city 75 miles from the sea on the Delaware River, the original entrance and channel had a depth of 17 ft. The channel was narrow, winding, and shifting. Improvements have given Philadelphia harbor a minimum depth of 35 ft and a width of 600 ft; the channel has been definitely fixed and maintained; and a suitable anchorage area has been provided. Similarly, at Baltimore a depth of 37 ft has been created, with a limiting width of channel of not less than 400 ft. Norfolk, with an original depth of 15 ft, now has 45 ft. At Charleston, S.C., there was one of the best natural harbors on the south Atlantic coast. At low tide there was from 15 to 20 ft on the bar. Now there is 30 ft on the bar and a corresponding depth at the wharves.

With this mention of but a few examples on the Atlantic coast, turn now to the Gulf where at Pensacola, Fla., there is the nearest thing to a natural harbor on this coast. In its original state, there was about 23 ft of water on the bar. Now there is a depth of 30 ft in the main channel and up to the docks. Similarly, Mobile in its natural condition had about 15 ft on the bar and not much more in the long reach through the bay. Since improvement there is 30 ft in all parts of the main channels and ample widths for modern navigation.

Both at New Orleans and between it and the river mouth there has always been a very deep channel, but at the various mouths of the great river there was a bar which at low tide was covered by not much over 15 ft of water. Now in the South Pass there is fully 30 ft of water at all times and in the Southwest Pass, 35 ft. The deepening of the passes of this river was one of the greatest feats of harbor engineering. Practically everyone knows of the jetties at the mouth of the Mississippi. Few know of the difficulties involved in building them, and fewer still know of the controversy over the effect that they would have. It required great faith and much courage to expend large sums of money on these jetties. Some of the best engineers the country has known were mistaken about their effect.

At Houston there is a remarkably successful port. Yet the city is on a bayou fifty miles from the sea, and the making of a port there seemed in the nature of a day dream. Now it is a dream realized. Success was achieved by excavating a channel across the wide, shallow reaches of Trinity Bay and along Buffalo Bayou. The channel is 30 ft deep and is wide enough for successful navigation by seagoing ships.

Constructing Stony Point Breakwater Extension
For the Improvement of the Harbor at Buffalo, N.Y.

On the Pacific Coast, also, much work has been done. San Diego has a harbor permitting use by the United States fleet, made by dredging and breakwater construction. At Los Angeles–San Pedro, a harbor has similarly been created for ships of all classes. San Francisco is one of the natural harbors of the United States and is of the first order. Much work has been necessary, however, to carry deep water to the port of Oakland.

At Portland, Ore., a first-class harbor has been made practicable by the jetties constructed at the mouth of the Columbia. Before improvement, the entrance to the mouth was one of the most difficult in the world owing to high seas and a rapidly shifting channel. Seattle has a good harbor, natural to some degree, but it was necessary to carry deep water to the docks.

Finally, on the Great Lakes, where originally there was not a single harbor that would accommodate a modern lake carrier, there are now a hundred. One of these, at Duluth-Superior, in normal times has next to the greatest tonnage of any harbor in the country—fifty million tons of freight per annum. Excellent harbors have been created at Detroit, Chicago, Calumet, Milwaukee, Toledo, Ashland, Ashtabula, Cleveland, Buffalo, Erie, Oswego, and many other lake cities. Because of the harbors created and the connecting channels improved, the Great Lakes have been made into the most economical system of water transportation that is to be found outside the high seas. This economy in transportation, together with other advantages has made the shores of the Great Lakes the industrial center of the United States, and has been a potent factor in the development of the nation's steel industry and of agriculture in the Middle West.

This rapid survey has of necessity touched only the major phases of a vast and intricate national accomplishment. Just now the appropriation of immense sums to extend these facilities for transportation by water has placed the stamp of approval on the many past years of effort. Engineers may take pride in such a retrospect.

Some Facts About Limestone

Including the Origin, Physical Properties, and Fabrication of the Building Stone

By Paul V. McHenry

Assistant Engineer in Charge of Stone Inspection, Modjeski, Masters and Case, Inc., Philadelphia, Pa.

First in importance among the many different varieties of stone used in the construction industry is limestone, which yields lime, portland cement, a flux for steelmaking, road metal, and in particular, one of the finest of the building stones. Of the various forms of limestone, the granular or oolitic type is the most used for building purposes, on account of its superior strength and appearance and the comparative ease with which it can be quarried and worked. The accompanying article by Mr. McHenry describes, first, the origin and stratified formation of oolitic limestone; next, the physical properties and most common defects to be found in it; third, the causes of discoloration; and finally, how it is quarried and fabricated, including the operations of channeling, sawing, planing, milling, heading, turning, and finishing. A valuable knowledge of what to look for in the finished product and how to avoid damage to either the strength or appearance of the stone during and after placement may be obtained by a specification writer, inspector, or construction engineer from a perusal of this paper.

Limestone occurs in many forms and in many places. This article deals only with that found in the state of Indiana, in Lawrence and Monroe counties, which is known as Indiana oolitic limestone. This is the purest deposit of this limestone yet to be discovered and the largest in extent. Over 60 per cent of all the building stone used in the United States is shipped from this district. Oolitic limestone has three qualities that make it ideal for building purposes: (1) Its structural merit, that is, its fairly high uniform strength and its ability to withstand all types of weathering without change in appearance or soundness; (2) its aesthetic appeal, due to richness of texture and pleasing light color tones which soften and improve as the structure ages, without damage to delicate carving; (3) its economical production, due to progress in quarrying and fabrication methods, and the ease with which the stone lends itself to these processes.

Limestone structures are as old as recorded history. The Egyptian limestone, of which the Pyramid of Gizeh and the Sphinx were built, was a similar stone, although according to geologists it was weaker and less pure and was formed at a later date than Indiana limestone. Most of the beautiful Gothic cathedrals of central Europe were wrought from oolitic limestone, as was also St. Paul's of London. Although mellowed by centuries of time, these buildings are still in a wonderful state of preservation.

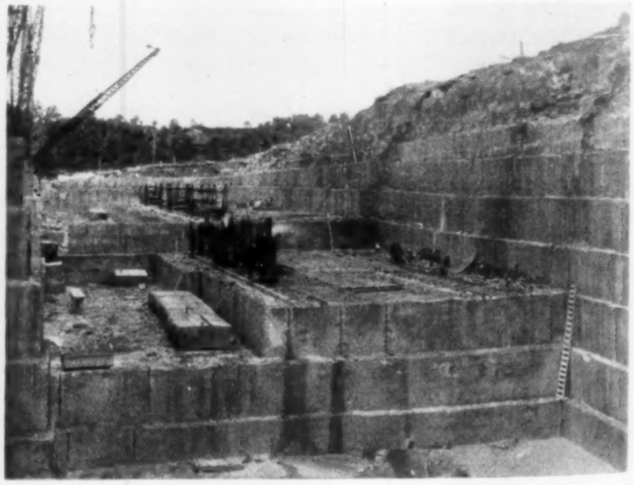
HOW LIMESTONE IS FORMED

The various kinds of limestone are formed by the deposition of calcium carbonate from three sources: Organic deposits from the shells and hard parts of sea animals and plants; direct precipitation from a supersaturated solution, with or without the aid of living matter; and recementation of fragments eroded from an older formation. The oolitic limestones were formed by a combination of all three methods.

A warm climate and an extensive area of shoal water favor the abundant growth of foraminifera, minute sea animals that consist of a single cell of living matter encased in a perforated shell resembling that of a snail. The cause of this growth is the supersaturation of sea water with calcium carbonate, furnishing material for the shells of all sorts of marine animals and growths. With a rise in temperature, chemical precipitation also takes place, in the form of minute grains or crystals, called "oolites." This precipitation is facilitated

Opening a New Quarry Floor

Soil Stripping Is Done by Water Jet. Black Powder Is Used to Break Up the Overburden Without Shattering the Commercial Stone. Electric Channelers Are Shown at Work in the Foreground, Steam Channelers in the Background. Each Machine Makes Double Cuts 4 Ft to 5 Ft 2 In. Apart, up to 12 Ft in Depth, and as Much as 200 Ft in Length. The First or Key Blocks of Each Floor Are "Rocked" Loose with Crowbars



Seven Floors Down in a Limestone Quarry

After the Channeling Has Been Completed and a Cut Drilled and Wedged Loose, It Is Pulled Over Onto a Cushion of Spalls by Means of a Block and Pulley System and Split with Power Drills. Thirty-Ton Derricks Then Lift the Blocks Either Direct to Storage Piles or Onto Industrial Railway Cars. An Electric Channeler Can Make a Cut 500 Sq Ft in Area in a 9-Hour Day. Note the Three Mud Seams Visible in the Ledge at the Right by the abundant growth of denitrifying bacteria, which generate ammonia.

These oolites derive their name from the Greek words meaning "egg-stone" because they resemble the eggs in the roe of a fish. They may be deposited without the aid of bacteria if the solution is in a constant state of movement and small particles are present to form the nuclei for the oolites. The grains fall to the bottom of the sea and are constantly shifted around by currents until they are covered by successive layers of shells and oolites. They then form a group of independent particles similar to sand until they are cemented together by further deposition of calcium carbonate.

Any increase in the velocity of the water, or a shifting of the currents, again picks up particles not yet cemented together, or erodes some of the newly formed stone and carries the particles in suspension. This action continuing, subsequent layers are sometimes deposited in a different direction showing marked difference in the bedding lines. This is known as "cross-bedding" and sometimes occurs as many as four or five times in one mill block. Faint erosion lines are not considered a blemish, but rather serve to break up the monotony in a large section of plain stone.

Where the character of the stone changes radically on a definite erosion line from a fine, dense, select grade to a coarse, shelly formation, such an abrupt change is known as an "unconformity." It is caused by the filling of depressions after erosion by larger or heavier pieces of shell or cemented fragments from a different part of the formation. Stones of this character may be used except where select grades are required.

GEOLOGIC HISTORY OF INDIANA OOLITIC LIMESTONE

Indiana oolitic limestone was formed during the Lower Carboniferous period, late in Paleozoic time. During this period the whole great central plain of the continent was partially covered by a shallow sea, extending from the Gulf of Mexico to the Great Lakes. Many changes took place in the extent of this sea, due to upheavals or depressions in the land. During invasion by the sea, limestones were formed, and during its subsequent retreat, sandstone was formed. During the last half of the Lower Carboniferous period, shale and limestone, some of it oolitic, were deposited. During the Upper Carboniferous period these beds remained above the sea for a time, but gradually sank beneath it until they were covered by great deposits of shale, sandstone, and coal. The end of this period was marked by the great upheaval that formed the Appalachian range of mountains in the east and uplifted the central plain on a gradual slope, to the position it occupies today. The region has been above sea level since that time and has been eroded by frost, stream action, and weathering, until the overburden has been worn off down to the limestone. Today the stone can be found within 10 to 50 ft of the surface.

This deposit could be compared to a gigantic slab 40 miles long and 5 miles wide, varying in thickness from 30 to 100 ft and estimated to weigh 18 billion tons. Although the supply would seem unlimited, the part that is salable is comparatively small because of the variations in quality of the deposit. The commercial limestone is usually found from 15 to 30 ft below the top of the stone ledge.

FLAWS FOUND IN LIMESTONE

Various types of flaws are found in this oolitic limestone formation. Among them are stylolites or "crowfeet," peculiar markings that zig-zag through the stone, parallel to the bedding, in some deposits. They consist mainly of a black bituminous shaly matter and pyrites. Although mostly black, occasionally they may have a brownish or greenish color. Where these crowfeet occur in a very thin layer, it does not detract from the structural soundness of the stone. Where they occur in very slight undulations or are of considerable thickness, they may become a plane of weakness, through rapid disintegration of the bituminous clayey material when exposed to weathering. Usually they are interlocked by the projecting points of stone over a sufficient distance to offset the weakening effect of the shaly material.

Scabbled Monolithic Columns, 88 Tons Apiece

Rough Scabbling Is Done with Picks; Then the Columns Are Turned on Lathes Which Take a $^{7}/_{16}$-In. Cut at a Rate of 5 Rpm. Back-Checking and Fluting, Where Required, Are Also Done on a Lathe. Note Storage Pile in the Background. Many of These Contain 60,000 Cu Ft of Blocks. Specially Constructed Wood Cradles Prevent Damage in Transit

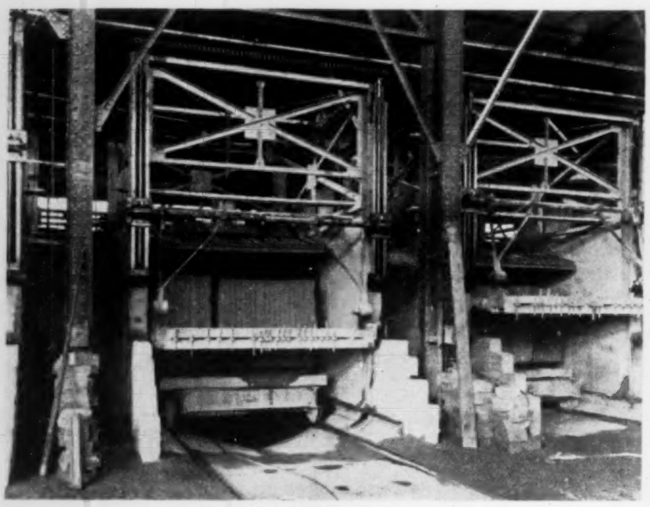
Glass seams, or calcite spots and streaks, are another characteristic of this oolitic stone. They are local spots or seams of calcium carbonate, of a very hard, glassy, and flinty texture. Far from being a weakness, these calcite deposits increase the strength of the stone and affect only the appearance. In some cases the cracks are only partly sealed. Thus cracks which appear to be "dries," or dry seams, are sometimes firmly cemented inside, so that what appear to be weak points are as strong as, or stronger than, the rest of the stone.

When there is doubt as to the soundness of a stone, the resonance test can be applied by striking it sharply with a hammer and judging from the resulting ring or dead sound whether the crack is firmly sealed. In select stone, glass seams are not allowed and only small ones are permitted occasionally in the standard grade, but in the variegated and rustic grades of both buff and gray they are permissible. This rule applies also to the "crowfeet."

"Beds," or open bedding seams, are cracks that occur in a horizontal plane and have not been sealed by the precipitation of the lime carbonate. "Dries," or dry seams, are cracks that occur in the vertical plane and have not been sealed, owing to an impenetrable layer of rock somewhere above. Any crack across the grain is usually designated as a "dry," and any crack with the grain, as a "bed." Both of these types of cracks were probably due to tension or shear caused by the shifting of the beds. These open seams are a plane of weakness, and stone containing them is discarded from the commercial grades. Some of them are so fine that they are not apparent on quarrying, but proper seasoning will usually bring them out.

COLOR VARIES FROM GRAY TO BUFF

The coloring of the stone is not regular and varies between gray or blue, and buff. Contrary to the usual opinion that the buff stone is a better grade than the gray, the difference is very slight, but the gray is the stronger. The original deposit was all gray in color, owing to finely divided black bituminous matter, accompanied by very small deposits of iron disulfide. On emergence from the sea, water percolating down through the stone oxidized the bituminous matter to a brownish color, forming the buff stone. Rust spots are usually found in the more porous or leached rock. Where the overburden is relatively thin, and the ground water at a considerable depth, the whole mass will be buff down to the ground water; where the overburden is dense and the water can penetrate only in mud seams, the buff color starts in a point at the top and spreads irregularly through the stone, depending on the course of the water. As the overburden becomes thicker and less penetrable, the percentage of gray stone increases until all is gray.



GANG-SAWING MACHINES AT WORK

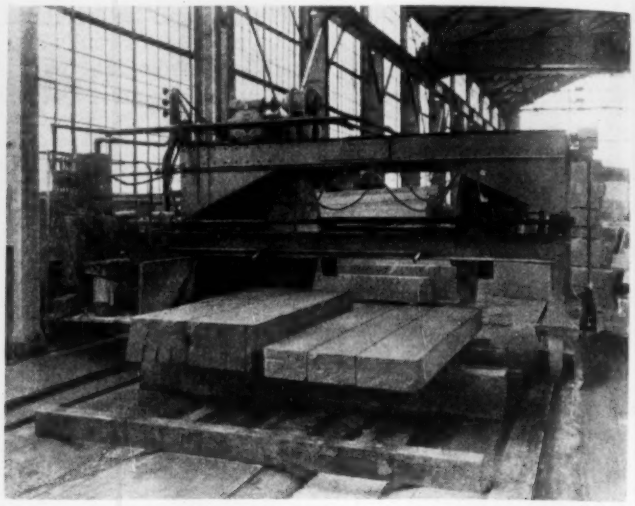
Reciprocating Saws with $^{3}/_{16}$-In. Blades Cut by the Use of Sand or Shot Abrasives. These Machines Will Saw a Block 11 Ft High and 16 Ft Long Into Slabs of Any Desired Thickness. The Usual Commerical Sizes Are 4-In. and 8-In., or 5-In. and 10-In. Slabs

The color of both buff and gray stone is very stable, as this process of oxidation was carried out over thousands of years. The only change that occurs after quarrying is a general lightening of tone, due to the drying out of the sap and evaporation of the minor volatile constituents of the organic matter.

A chemical analysis of the stone reveals that although the bulk is pure calcium carbonate in various forms, there are also small quantities of silicon, iron, aluminum, magnesium, potassium, sodium, sulfur, and traces of organic matter. As the carbon dioxide in the air is the most active solvent of limestone, exhaustive studies have been made of the rate of weathering of the stone when exposed to normal city air and rainfall. The results show that under ordinary conditions it would take from 150 to 500 years to wear the surface down 1 cm.

STAINING CAN BE LARGELY AVOIDED

Staining or efflorescence of oolitic limestone on newly erected structures has been a considerable source of worry to users. The stains may be of three sorts: (1) Green, black, or brown stains that have been washed down from exposed copper, iron, or bronze work; (2) white efflorescences; and (3) brown and blue-black stains that have no visible connection with any external source of staining. The first kind may be avoided by so designing the structure that drippings from metal work will be carried off through the interior of the building. These stains are the result of the reaction between the iron and copper chlorides, carbonates, and sulfates, and the limestone, which result in the deposition of iron hydrate and copper carbonate.



CIRCULAR DIAMOND SAWS USED FOR JOINTING AND BEDDING

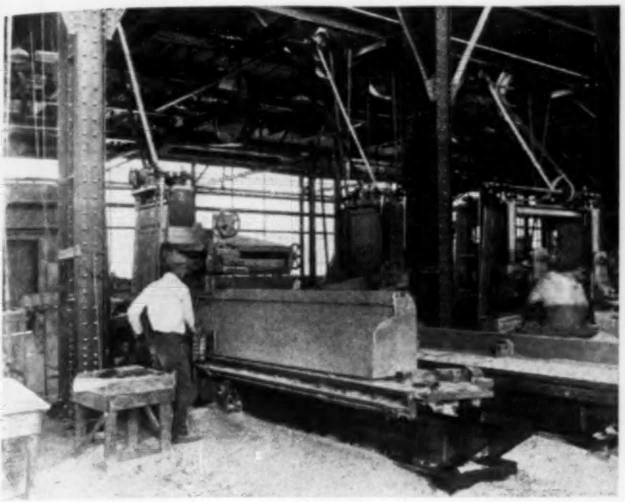
These Blades, 54 In. in Diameter, Are Mounted on a Movable Platform. The $^{1}/_{4}$- or $^{3}/_{16}$-In. Steel Blades Each Carry a Set of Yellow, Black, or Flawed White Diamonds Weighing from $^{1}/_{2}$ to $2^{1}/_{4}$ Carats Each, and Worth \$300 to \$500 per Set

The white efflorescences are caused by the deposition of salts by the evaporation of water that has been drawn out of the stone. This may be sap from insufficient seasoning, but in most cases is water that has worked its way through concrete or brick backing and has dissolved soluble salts from it as well as from the mortar. The third source of staining is caused by the reaction between the soluble salts from the cement and the organic matter in the stone itself. This stain usually has a glassy appearance due to the glaze of calcium carbonate containing the finely divided black organic matter drawn from the stone.

The white efflorescences and the blue-black stains can be avoided by various means: (1) By using only thoroughly seasoned stone, (2) by using materials in the backing and in the mortar that contain little or no soluble salts, and (3) by guarding against possible seepage of ground water from the backing or the ground by parging and damp-proofing.

The physical properties of this stone are so closely interconnected that its unit weight or specific gravity may well serve as an index to all the rest. The specific gravity and porosity determine the unit weight, and the amount and character of the porosity determine the absorption and the resistance to freezing. Specific gravity, porosity, and unit weight depend on the degree of cementation, which largely determines the crushing and transverse breaking strengths, the elasticity, and the resistance to abrasion. The normal stone has a specific gravity of 2.3 and weighs 144 lb per cu ft.

Although tests conducted by the U. S. Bureau of Standards for all grades of limestone show a range of crushing strengths from 2,720 lb to 17,700 lb per sq in., the average strength is between 6,000 and 7,000 lb per sq in. The stone is supposed to offer the greatest resistance to crushing when placed on its natural bed. Although this is usually true, some tests show a slightly higher strength when the specimen is placed on edge. The difference in strength between the two positions is very slight. The extremes computed for the modulus of elasticity were 1,500,000 lb per sq in. and 10,000,000 lb per sq in., but the accepted figure is usually 5,000,000 lb per sq in., representing the normal grade of stone. Although the stone is very rarely stressed up to 1,000 lb per sq in., owing to superimposed loads in the finished structure, cracks and spalls occur sometimes and are blamed on faulty stone. Usually this is due to improper setting or poor pointing, so that the stress is concentrated along one edge. Foundations are sometimes inadequate, and if settlement ensues, cracks are bound to occur.



Profiling a Cornice on a Planing Machine

Planers May Be Single as Shown in the Center, or Double, as at the Right of the Photograph. Double Planers Can Handle Two Pieces at the Same Time But Cannot Plane Returns. Both Top and Side Headers Are Provided

Battery of Planers in an Indiana Mill

Spalls and Planer Dust Are Shoveled Onto an Endless Belt in the Rear of the Planers, Which Carries Them to the Freight Cars. They Are Later Sold as Flux for Steel- and Glass-Making and for Water Supply Treatment

METHODS EMPLOYED IN QUARRYING

Quarrying limestone is one of the most interesting procedures in the stone industry. After it has been ascertained by means of core borings that a stone deposit is of uniform fineness and texture, the stripping of the overburden is started. The earth is washed away by water pressure, using a jet from a specially constructed nozzle mounted on a tripod, usually at a pressure of 200 lb per sq in. A considerable layer of shale and Mitchell limestone has to be removed by drilling and blasting before getting down to the commercial stone. The debris is removed by either a steam shovel or a cableway. After the oolitic limestone ledge has been uncovered, it is washed clean with a high-powered jet, and the stone is ready for channeling. The channeling machine, which is either steam-powered or electrically driven, cuts a groove 2 in. in width by means of a series of cutting drills, or chisels, operating in a vertical plane, under a continuous flow of water. These machines run on rails and move backward and forward as the cutting progresses. The channels may be of any desired depth up to 12 ft, the usual depth of a level or floor. The cuts are usually about 4 ft apart.

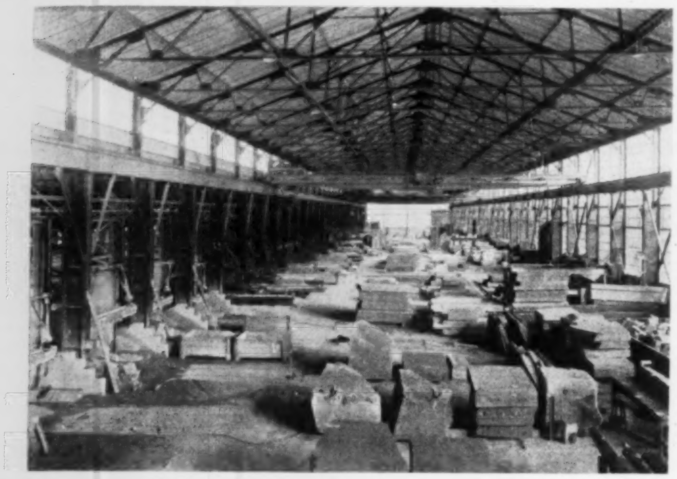
On opening a new floor, two channels about 8 ft apart are usually cut, and then transverse cuts are made every 2 ft to the desired depth of the floor. These stones, or "key blocks," are broken free from the stone below by wedging in the channel cuts, and are lifted out with hooks. The removal of a few of them leaves room to remove the rest of the key block row with the usual width of about 4 ft. After the ledge is opened, the channeling machines continue their cuts over the entire floor, parallel to the key block row. A row of holes is drilled at the bottom of the channel cut, so that the stone will break on that line when wedged against the adjoining rock at the top of the cut. These cuts will sometimes have a length of well over 100 ft. After they are separated from the main body of the stone, they are overturned by a system of cables and pulleys, hooked over the top of the cut, and connected to the load line of the derrick. Rows of small chunks or spalls of stone are placed on the opened floor to take up the shock of the overturning block and, in being crushed, prevent the splitting or breaking of the new cut. After a cut has been laid on its side, the blocks or special dimension stone are drilled from it and split off by the plug-and-feather method. The stone is then notched on the ends and lifted out by means of hooks and a chain, and either placed on a flat car for shipment to the mill, or stacked in the quarry yards.

After reaching the mill, the stone is sawn into slabs by shot-type or sand-type gang saws. Cuts are made either with the grain or across the grain, whichever gives the more economical cutting. Gang saws consist of a series of flat steel blades stretched on a frame which moves back and forth across the stone. The saws cut by means of an abrasive mixture which is fed from above. In the sand gangs, the abrasive mixture is sharp sand and water; in the shot gangs, it is sharp sand, crushed steel or chilled shot, and water. In the case of shot sawing, the surface finish of the stone is characterized by a series of horizontal grooves and ridges spaced irregularly over the face, due to the rolling of the shot alongside the blade in the cut. In sand sawing, the surface finish is of uniform texture, depending on the fineness of the sand used.

As only a little over a third of the stone quarried is fabricated by the mills in the district, the great bulk of it is lifted off the gang platforms and placed in cars for shipment to all parts of the country and subsequent cutting in the smaller shops and yards where it is to be used.

PROCESS OF MILL FINISHING

Assuming that the slab is to be finished before shipment from the mill, if it is coursed ashlar it next goes to the diamond rip saw. This consists of a circular steel blade, with a series of cast-steel teeth containing black diamond cutting points. The saw consists of two similar rotary blades mounted on a common shaft, so that the distance between them can be varied. The stone slab, mounted on a car platform, is moved through the blades by means of a worm attachment on the platform. Multiple sawing is done by laying the slabs on top of each other to a thickness slightly less than the radius of the blade. The diamond joint saw, or gantry saw, is similar to the rip saw, except that the stone is held stationary while the blade moves through it by means of a worm attachment on the blade. The third diamond saw is the "drag saw," consisting of a straight steel blade with teeth inserted in the lower edge, which moves with a reciprocating motion. It is used where the cut is too large for the rotary saws. All the diamond cutting is done under a spray of water to dissipate the heat.



INTERIOR OF AN INDIANA STONE MILL
Along the Left-Hand Wall May Be Seen Batteries of Sand Gang Saws, Planers, and Diamond Saws. The Stone Is in Various Stages, from Rough Blocks to Finished Slabs. This Building Is 80 Ft Wide and 625 Ft Long

After the slabs have been ripped to the desired thickness between beds, they are jointed to the desired length and are ready for drilling and marking as coursed ashlar. Any variation from the rectangular shape is effected either by hand cutting or by machines. The machines are of three sorts—the planer, the milling machine, and the header.

The planer consists of a moving platform, on which the stone slab is securely wedged into place and above which is a cutting tool. After planing, the stone is cut on the joint saw to the desired length. On delicate pieces, where there is danger of chipping or spalling at the end of the cut, wads of plaster of paris and excelsior are fixed at the desired points. After the cut is made, the mixture is scraped off, leaving a sharp joint. The milling machine is similar to the planer, except that the tool rotates and the platform is stationary. It is used for cutting slots or for roughing out pieces that will be finished later by hand.

The header, which is similar to the planer except that it has only tools mounted on a vertical post, is used to cut a smooth vertical surface on a return, or corner. The tools are fixed and the platform moves back and forth beside them. This machine is adaptable to many uses, an interesting one being the fluting of columns, where a curved tool is substituted for the straight one, the column being mounted on axes similar to those of a lathe. For drums of short lengths, this combination has been used so that the whole column is turned and fluted without being moved from its position during the operation. The lathe is similar to that used in the fabrication of steel but much larger.

HAND FINISHING STILL INDISPENSABLE

After all the mechanical fabrication possible has been done, the stone-cutter must still be depended upon to give personality and life to the stone. Delicate scroll work and Gothic tracery, as well as carved figures of heroic size are produced with equal facility and without apparent effort. In the last decade stone cutting has been greatly facilitated by the introduction of the compressed-air-operated chisel and the carborundum hand saw. These two important hand tools have completely eliminated the old-fashioned mallet and chisel.

After the stone comes from the cutter, or from the machines and saws, it is brought to the skidway, the last step in the fabrication. Here skilled workmen put on the final finish, drill anchor and dowel holes, and either Lewis holes or box Lewises for lifting and setting. The finishes may be either dry or wet sand-rubbed, smooth or carborundum finish, or, as in the case of shot-sawed stone without markings, imitation shot-sawed. The stone is then given its individual number and marking and is ready for shipment.

Whether the stone is large or small, it is securely blocked in the car and packed with a cushion of excelsior, to prevent damage in transit. When the stone is stored on the job, care should be exercised in placing it in the stack, so that it does not draw water from the ground, and by seeing that the beds are separated by padding to prevent spalling and chipping when moved. In the winter, ice should not be allowed to form in the Lewis holes, and under no consideration should salt ever be used to melt ice on the stone.

One of the points of expense most frequently overlooked on a stone structure is that of carving in place. Such carving is usually done from 30 to 60 per cent cheaper in the mills where the stone is fabricated than at the site, and there is no possibility of an unsatisfactory job because it can be inspected and approved or rejected before it is placed. When the work proves unsatisfactory after being carved in place, there is no hope of anything more than a cash remuneration, after a long and expensive court suit. Although this has been illustrated many times, some of our best architects always include in their specifications the provision that all carving shall be done in place.

The Indiana limestone country has felt the paralysis of the construction industry probably as keenly as any other section of the country, so that in 1935 it is operating at only about 6 per cent of capacity. The best hope for the future may lie in finding a new use for the stone in a broader field than that of large structures.

Indebtedness is acknowledged to Mr. Gustav Stieglitz, vice-president of the Indiana Limestone Corporation, for the use of illustrations and for helpful information. The cooperation of Mr. John Furlong, president of the Indiana Limestone Company of New York, Inc., is also acknowledged. Some of the data presented were taken from the reports of the U. S. Department of the Interior.

What Is Suretyship?

Varied Aspects of an Important Business Vitally Related to Engineering

By Herbert M. Knight

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Engineer, Maryland Casualty Company, New York, N.Y.

In Bible times suretyship was purely a personal matter, between man and man. But with the establishment of corporate suretyship in the middle of the last century and its subsequent development into a vast enterprise, many ramifications of the early simple relationship have grown up. In this preliminary paper, Mr. Knight explains the essence of suretyship and the variety of contract bonds available today to fit the myriad needs of modern construction. While complete in itself, this article will be supplemented by additional papers dealing with other phases of this problem so intimately related to engineering. All of these papers originated in a talk before the Brown Engineering Association on October 30, 1934, in New York, N.Y.

ENGINEERS may think that an apology is due them for opening the subject of surety bonds—first, at the implication that they do not know much, or all, about such bonds, and second, at the introduction of a subject which is anathema to many of them. It recalls to me quite forcibly a meeting with a former associate. In response to his inquiry I told him that I was engineer for a surety company, upon which he allowed himself some rather forcible language and ended with the exclamation, "Quit it and get back into respectable engineering." But whether considered respectable or otherwise, suretyship is a great and growing factor in the complex world of business, and a factor upon which the destinies and dividends of many, if not most, engineers are inextricably dependent.

Therefore I will endeavor to disclose some of the little-known elements connected with suretyship, and at the same time hope to arouse a feeling of respect for so important a feature of modern business and construction life.

MANY HISTORICAL ANTECEDENTS

While it is exceedingly new and modern in its present applications, the business of suretyship is one of the most ancient of the activities of man. Job mentions it, and Joseph demanded it of his brethren in Egypt. Solomon refers to it not once but many times, and his warnings and conclusions are so apt as to warrant quoting a few verbatim: "He who loathes being a surety is in a safe position"; "He that is surety for a stranger shall smart for it"; "He is devoid of sense who goes bail, who becomes surety for another."

Shakespeare, too, in the Merchant of Venice uses the vicissitudes of those who become surety as the theme of one of the most absorbing dramas of all literature, and his points are so well taken, so apt, so applicable to the field of suretyship today, as to make it in a measure a treatise rather than a play.

These illustrations indicate the cardinal fact that in its inception all suretyship was personal, that is, individual and not corporate. Individual suretyship has existed for indefinite ages; corporate suretyship is a very modern implement—a veritable infant, and yet a Goliath even in its infancy.

Around this fact much of the jurisprudence relating to suretyship has been built up, because from its inception until comparatively recent days to become surety was an individual matter, largely founded on the basis of friendship or relationship, and without thought of remuneration. Accordingly, because the act was friendly and non-remunerative, courts were very lenient in imposing penalties on the surety. But with the inauguration of corporate suretyship, where the protection was offered, and for compensation, that is, a consideration, the reverse held true, and many of the decisions and judgments against surety companies are directly at variance with what had formerly been held as fundamentally just and equitable as between man and man. Such a tendency can only be interpreted, often, as an unwarranted and nearly universal antipathy to an unappreciated business friend.

Corporate suretyship was first attempted a little more than a hundred years ago when a company of people assembled in the Devil's Tavern in London for the purpose of organizing a company to indemnify householders against the speculations of their servants. The meeting place, bearing such an unattractive title, was surely not an augury of success for the new enterprise and in some degree may account for the vicissitudes which surety companies have suffered since that time. However, whether due to the inauspicious meeting plan or to some other and unknown cause, this first venture was a failure. Not until 1840, when the Guarantee Society of London was formed for the issuance of fidelities, did corporate suretyship commence an unbroken existence. The first enabling act permitting the conduct of suretyship in the State of New York was passed in 1853, but not until 1872 were any of the existing operating companies incorporated. That is, on the basis of continuous corporate life, suretyship in America is only slightly more than 60 years old.

SURETYSHIP IS DISTINCT FROM INSURANCE

Probably the best way in which to define what suretyship is would be to state what it is not. Suretyship is not insurance. The surety company is a purveyor of credit—the guarantor of an obligation. All that a surety company does is to endorse the corporation or the individual as capable, competent, or trustworthy. Surety bonds, and the rates for surety bonds, are conditioned upon this primary proposition.

In this respect the marked difference between surety and insurance is immediately apparent. Fire insurance is based on the theory of probability, that fires are bound to occur—that a certain and ascertainable monetary loss will be incurred through the average year—and rates are adjusted in accordance with this theory, based on the accumulating experiences of the years. Again, life insurance is based on the certainty of death, and the life expectancy of people of varying ages as determined by vital statistics of many years of record. In both these major lines, long years of statistics and abstruse calculations have reduced the questions of hazards, exposures, and coverages to almost an exact science, with practically nothing left to uncertainty.

Further, no fire or life insurance policy is written with the certainty, or even the possibility of salvage in the event of loss. When the property is destroyed, when the individual dies, the insurance company pays the penal sum of the policy and the transaction is at an end. When a surety company pays a loss on a bond, it immediately moves, by every business and legal means, to salvage the loss, to recover from the corporation or the individual in whose behalf the bond was written and to whom it loaned its assets and its credit the entire amount of loss which the said surety company has sustained because of a default in said bond.

TABLE I. CLASSES OF SURETY BONDS

- CONTRACT BONDS
  - *Bid or proposal*
  - *Certificate of surety*
  - *Performance*
  - *Completion*
  - *Maintenance*
  - *Supply*
  - *Labor and material*
  - *Annual guarantee*
  - *No lien*
- FIDELITY BONDS
  - *Individual*
  - *Position*
  - *Blanket (bankers)*
  - *Public official*
  - *Forgery protection*
  - *Weighers and inspectors*
- DEPOSITORY BONDS
  - *Individual*
  - *Governmental*
- INDEMNITY BONDS
  - *Lost securities or other instruments*
  - *Guaranteeing payments of rent or similar obligations*
  - *Mortgage guarantees*
  - *Gasoline taxes*
  - *Freight charges*
  - *Tax abatement*
  - *Actors equity*
  - *Alimony*
  - *Charter party*
  - *Taxes and other state charges*
- JUDICIAL BONDS
  - Probade or fiduciary
    - *Guardians*
    - *Executors*
    - *Administrators*
    - *Conservators*
    - *Trustees*
  - Court
    - *Replevin*
    - *Release of lien*
    - *Appeal*
    - *Costs*
    - *Receivers*
    - *Discharge of attachment*
    - *Deficiency judgment*
    - *Postponement of trial*
    - *Stay of execution*
    - *Stipulations*
  - Bail
- LICENSE AND PERMIT BONDS
  - *Street opening or obstruction*
  - *Hoisting*
  - *Sidewalk*
  - *Storing of explosives*
  - *Blasting*
  - *Auctioneers*
  - *Junk, pawnbrokers, and second-hand dealers*
  - *Employment and other agencies*
  - *Laundry*
  - *Concessionaires*
  - *Sign*
  - *Plumbers*
  - *Exhibition and entertainment*
- MISCELLANEOUS
  - *Custom house*
  - *Excise*
  - *Milk dealers*
  - *Produce, and other commission dealers*
  - *Warehouse*
  - *Immigrant*
  - *Patent infringement*

At this point, however, I should call attention to the fact that there are no simon-pure surety companies, that is, companies which confine themselves exclusively to the execution of bonds. All surety companies are polyglot institutions, combining suretyship with insurance—writing casualties and liabilities as well as guarantees. This fact very materially complicates the problems of present-day suretyship but in no way changes or modifies the primary principles just stated—that suretyship, of itself, is in a class distinctly different from insurance. The complexity of the activities of surety and casualty companies has its advantages in that companies writing "multiple lines," as they are termed, are able to give a wider and better service to their clients than are those confining themselves to a "single line" of writing.

Now this very variety of writing—this effort to give clients a maximum of service, makes the conduct of a financially successful surety or casualty company a very difficult and uncertain occupation. Unlike the executive of a fire or life company with a single line to consider, the executive of the casualty company must so coordinate his multiple lines as to do a profitable business from the sum total of all; and since many casualty lines cannot be written at a profit, and never have been except at prohibitive rates, some part of the business must of necessity be written at rates above the absolute cost in order to equalize and overcome losses on business which by its very nature is unprofitable. This explains in a measure why some rates seem to be higher than is reasonable. It may also assist the engineer in understanding more clearly how difficult is the work of the surety executive and how creditable are his achievements.

SOME COMPARISONS VISUALIZED

A graphic portrayal of some of these relations may be enlightening. In Fig. 1 it is shown conclusively that during a period of 24 years sureties which are essentially represented by the summation of contract bonds, fidelity bonds, and judicial bonds, have averaged very close to 25 per cent of the total business of multiple-line companies, while casualties and liabilities, which are insurance, have averaged 75 per cent. Again this graph clearly indicates that the losses on casualties and liabilities have been proportionately higher than the losses on sureties and fidelities.

Similar relationships are shown in Fig. 2, which refers to the total business of these companies as measured by the aggregate premiums. This diagram indicates that in 1928, for example, the surety and fidelity, or bonding business, amounted to about $83,000,000, while the casualty and liability business amounted to about $300,000,000.

Suretyship is not a fixed science in any sense. The business is nascent, and is now, and for several years to come, will be in a state of flux. Until the multiplied years of experience in the writing of a complicated, varied business have been crystallized into definite relationships of hazard to return—similar to fire, marine, and life insurance—changes in rates and policies are bound to occur.

That portion of the business of surety companies known as "bonding," as differentiated from their liability and casualty business, is clearly divided into seven major divisions, given in Table I. These divisions are redivided into a multitude of subdivisions, and these subdivisions are again marked by many and varying rates and forms, all these details being for the purpose of more fully and equitably making the cost of carriage fit the coverage.

VARIOUS TYPES OF BONDS OFFERED

Naturally engineers are far more interested in contract bonds than in other forms. In effect, contract bonds, whatever their specific form or variations in detail, are conditioned upon performance of some construction as delineated and described in plans and specifications, and upon compliance with the terms and stipulations of the attendant contract. As shown in the first group of Table I, contract bonds are of nine types. Due to an unfortunate lack of uniformity in the terminology of bonding, the same term does not always indicate exactly the same instrument to various underwriters, but in general the designations to be given closely represent the various types.

Bid Bond. This is a bond issued for a prospective bidder in favor of the owner, guaranteeing that, in the event the contract is awarded to the bidder, he will enter into the contract, or, in the event of failure so to enter, the surety will pay to the owner the damages resulting from such failure to a maximum of the penal sum of the bond. Such bonds are usually for a percentage, usually from 10 to 25 per cent of the estimated total of the contract. The fee for such bonds is $5, whatever the size of the contract, whether for $5 or $500,000. It relieves the contractor of the necessity of depositing a certified check and having such check held for an indefinite period, or of losing it in the event of his failure to enter into the contract. Bid bonds are difficult to write for other than well-known clients. The hazard is usually heavy. The fee is small, while often as much work has to be done in connection with a bid bond as for a final bond, and as only one bidder can be successful, many bid bonds, despite the preliminary work involved, bring no adequate return to the bonding companies, which often spend hundreds or even thousands of dollars and get a $5 fee.

Certificate of Surety. In all essential respects this type is similar to a bid bond. It differs in that no penal sum is mentioned, the surety guaranteeing simply that, in the event of an award to a specified bidder, it will execute said bidder's bond.

Performance Bond. This instrument guarantees the completion of the construction in accordance with the plans, specifications, and contract. It was once the usual form of contract bond—the one most safely and easily written. It was less of a financial guarantee and more a guarantee of skill and trustworthiness. It is still a very common bond, and because of its clear and unfettered character carries in some special cases a comparatively low rate. Many performance bonds provide for payment of bills as well as for performance of work.

Completion Bond. This is a "performance" bond plus a "full payment" provision. It is a contract bond plus a financial guarantee. The payment of all bills is guaranteed as well as the completion of the work. This form is usually issued when construction costs are met by loans. It carries a high rate, but even at that it is very difficult, almost impossible, to get one executed. The experience of surety companies with this type of obligation has been sadly disappointing.

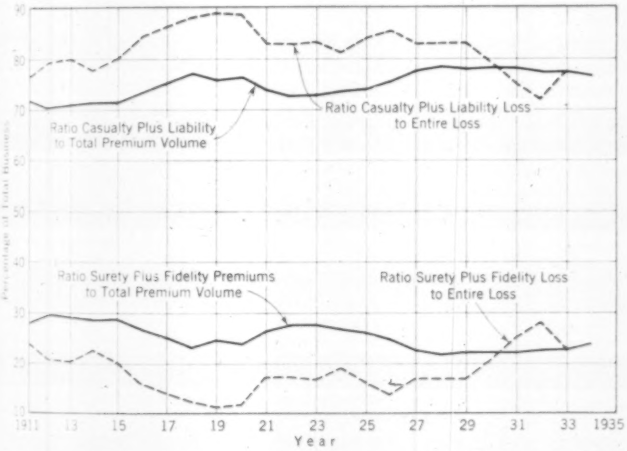

Fig. 1. Percentages of Business of 29 Multiple-Line Surety and Casualty Companies During 24 Years

Practically 75 Per Cent Is Casualty and Liability Whereas Only 25 Per Cent Is Surety Business

Maintenance Bond. Such a bond guarantees quality of material and workmanship, or maintenance of construction, for a longer period than the life of the primary or performance bond. It sometimes fulfills a requirement of the performance bond and is sometimes independent. The period of maintenance and the requirements in connection therewith are often very extended and extreme and would seem to cast doubt upon the care or intelligence of the engineers or the inspectors by whom the specifications were drawn or the work executed. Except as corollaries of performance bonds, maintenance bonds are not favorably regarded.

Supply Bond. This bond guarantees that goods, articles, machinery, or things other than heavy and permanent construction, will be furnished and supplied. It is usually required by the federal, state, or municipal agencies in connection with the unlimited amounts and varieties of things required in the conduct of government, from ammunition to water softeners. Specifically, such articles are transportable entities as differentiated from fixed entities, such as buildings and general construction. The risks are comparatively light and the rates low.

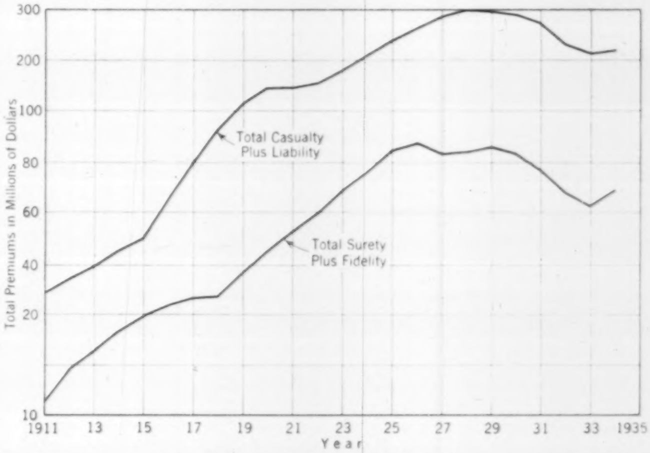

Fig. 2. Amounts of Business of 29 Representative Surety and Casualty Companies During 24 Years

Trend of Yearly Premiums Shows Culmination at About 1928

Labor and Material Bond. This is a "direct-right-of-action" bond, accompanying a performance bond. It is distinctly for the benefit of laborers, workmen, supply houses, and material men, who supply work or material in connection with construction. It requires a premium in addition to the performance premium, and rightly so.

Annual Guarantee Bond, Bid and Final. This is a bond in favor of governments, a single instrument guaranteeing that a certain principal will perform all contracts for supplies which may be awarded to him, during a fiscal year, or that he will enter into such contracts if his bid is accepted.

No Lien Bond. This is a separate bond, tantamount to a release of lien bond, but which is issued in advance of liens, guaranteeing that none will lie. It does not guarantee performance of the contract and often is not required.

DIVISIONS NOT FIXED

Some underwriters may cavil at a number of the foregoing designations and definitions as not being complete or absolutely exact, but for the non-legal reader they are sufficiently comprehensive and correct.

These quick views of suretyship as a whole and of some of the essential features of contract bonds should provide a general understanding of the main attributes of a vast business closely affecting engineers and engineering construction.

Official City Plans Attain New Importance

Effect of Depression on Urban Property Values Emphasizes Desirability of Adequate Planning

By HARLAND BARTHOLOMEW

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OVER-EXPANSION of American cities during the seven fat years immediately preceding 1929 is generally recognized as a major factor in the ensuing collapse of urban property values. The municipal extravagance and waste entailed by the process of unregulated growth of suburbs, coupled with unregarded central decay, is comparable only with the destruction of war. Some practical suggestions looking toward the correction of these conditions are made in this article, taken from an address made by Mr. Bartholomew before the Civic Development Department, at the Twenty-Second Annual Meeting of the U. S. Chamber of Commerce, Washington, D.C., May 1 to 4, 1934.

THE objective of all planning is to achieve a satisfactory standard of living for all groups of the population. Much of our present-day interest in planning centers around the possibilities of improving rural living conditions through state and national planning. However, since the population of the country is divided about equally between rural and urban dwellers, we must not lose sight of the fact that there is great need for improvement of urban living conditions. Economic necessity compels a new consideration of the structural form of the American city. Is it altogether sound and good? Is it fixed in form, or is it undergoing a fundamental process of change? What improvements or controls, if any, would be most desirable? These are questions of profound interest to all urban dwellers.

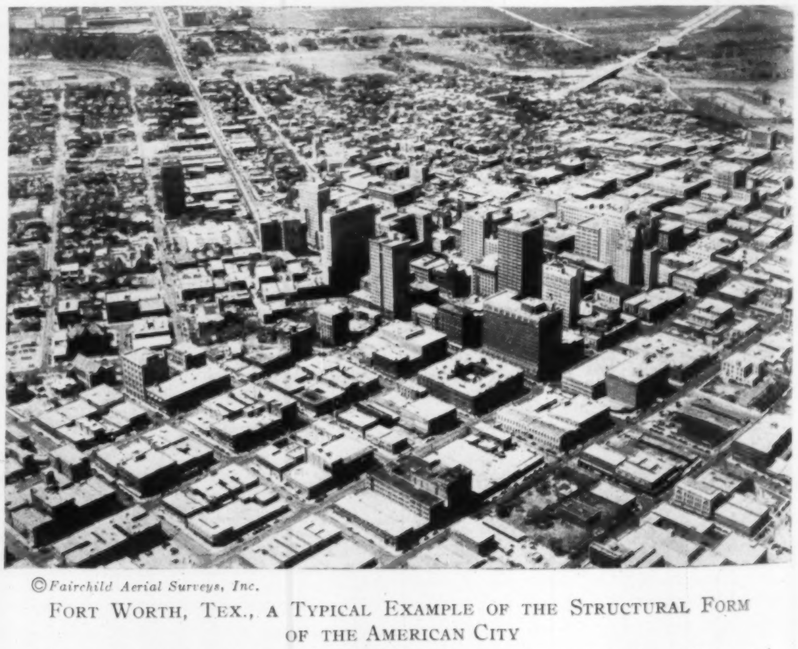
Regardless of size or location, our cities follow much the same structural form—a main business center, industrial area adjoining the rail and water transportation lines, and residential districts in the intervening or surrounding land. This is a simple and logical pattern. Unusual topography, such as hills, valleys, lakes, or streams, may introduce difficulties, but they do not change the basic scheme. Small cities have few planning problems because they start out with a simple pattern. Large cities would have comparatively few planning problems if the simple principles of basic design were accepted and followed. Unfortunately, as cities grow they depart more and more from these principles, with a consequent increase in confusion and waste.

COMPREHENSIVE PLANNING NOT YET ACHIEVED

The extravagance and waste in building the average American city surpasses that in any other field of endeavor with the single exception of war. A few cities have creditable planning achievements, such as street widening, a civic center, or an expansion of recreational areas. Most cities have zoning ordinances of varying degrees of effectiveness. Practically all cities, however, have failed to achieve genuine economy in the total process of city building. They have also failed to achieve a high standard of living conditions throughout the entire structure of the city.

For want of more definite planning, the average city has become unsound in several respects. The area of expansion is far greater than is warranted by any probable growth. Among the factors combining to cause expansion beyond reasonable limits are improved transportation, excessive speculation, and the lack of a definite urban land policy. No longer is it possible to consider the city in terms of unlimited growth. Most cities are now over-expanded, and public service facilities have been provided on too generous a scale, with an unjustifiable burden of maintenance cost resulting.

Large areas of the city of today are allowed to disintegrate with no prospect of rehabilitation—another factor making for unsoundness. Such large areas of old residential properties have been zoned for commercial and industrial purposes that there is no hope of their absorption for such purposes. Misguided property owners, hopefully awaiting a more lucrative use of their land, allow their properties to depreciate and tenants to move away. This means that the less fortunate part of our population, which is compelled to remain in these areas, is forced to put up with dilapidated dwellings. Not merely is this policy of shift and abandonment expensive from the standpoint of the individual owner, but it is doubly costly to the city, for disease, delinquency, and crime thrive in these areas. Of course, it is necessary to maintain regular city services, but since net property values have de-



©*Fairchild Aerial Surveys, Inc.*

FORT WORTH, TEX., A TYPICAL EXAMPLE OF THE STRUCTURAL FORM OF THE AMERICAN CITY

With a Main Business District, Industries Along Transportation Lines, and Residences in Intervening Areas. Note High Buildings Within a Small Area, While Buildings in Adjoining Blocks Rarely Exceed Three Stories in Height creased and tax collections have diminished, tax expenditures are today two or three times greater than the amount of tax collections. These slum areas, therefore, are actually subsidized by taxes paid by all other owners of property elsewhere in the city.

Instability and unsoundness of property values likewise affect the economic balance of the city. The idea of permanence seems to be quite absent from American cities. We have no definite urban land policy, except that of rapid shift and abandonment. We have been satisfied to create new values at certain centers of concentration or on the outskirts of cities at the expense of established values. Now, however, we have reached the point where the destruction of old values exceeds the creation of new ones. This condition cannot continue.

CONDITIONS RESULTING FROM INADEQUATE COMPREHENSIVE PLANNING

It is thus seen that the average American city is, on the whole, a very extravagent and unsound structure. There is an ever-growing slum area at the center, surrounded by larger areas of residential property in various stages of depreciation with only a fringe of new, high-value residential property on the outskirts. The American city has been altogether too largely "just a vast speculation in real estate." No wholesome social conditions or economic stability can continue to exist under such conditions. Soundness and stability for the individual property owner can come only as a result of wisely conceived policies of control, enforceable over the whole area of growth. There is no middle ground. Either we must organize to control the growth of our cities, or we must prepare to pay an increasingly exorbitant price for a policy of extravagance and waste.

Should This Vacant Land in Chicago Be Used for Parks, Houses, or Factories?

Sound City Planning Based on Accurate Surveys Would Determine Its Best Use

From 1920 to 1929 speculation in city real estate undermined the structural stability of the American city. The collapse in urban property values has been as great if not as spectacular as the collapse in security values. Both collapses were inevitable, as the rise of both property and security values was founded on speculation rather than on social and economic need. The misfortune with respect to urban property, however, is much the greater, since the damage is physical in character and cannot be repaired quickly. Recovery in urban real estate involves a long process of reorganization in the building process of the city as a whole, considering it as a unit wherein there is a nicely balanced arrangement of the component land uses—residence, business, and industry.

In a period of social and economic upheaval, such as the present, all things are subjected to close scrutiny and appraised in the light of their true value to society. The city is now quite properly the subject of such scrutiny. Because of the recognized wastefulness of methods of urban growth, will people abandon the cities for a more rural environment, for a closer connection with the soil? Or will they remain in the cities under a new set of conditions frequently but vaguely described as a decentralized city? Shall we build new cities? Will the large blighted areas of cities be abandoned; or should they be converted into parks, or used for industrial or other purposes?

Properties Within One-Quarter Mile of the Business District of a Large City

It Is Highly Improbable That They Ever Will Be Used for Business or Industrial Purposes

CITIES WILL CONTINUE TO GROW

It is hazardous to predict the future. Past experience, however, is man's best guide, and this should be true in the planning of cities. The history of the older European countries indicates that from 75 to 80 per cent of the population tends to become urban. In America much land is still available for occupancy and development, but nevertheless rural population declined from 1900 to 1930. The trend back to the farm in 1930, 1931, and 1932, caused by the depression, was again reversed in 1933. It seems safe to predict, therefore, that the percentage of urban population will probably increase, possibly to 70 or 75 per cent of the total. Our cities will consequently continue to grow, although at a very much slower rate because of the slackening in total population increase due to restricted immigration and a declining birth rate.

PROBABLE FORM OF THE NEW CITY

It is doubtful if much of our population could be redistributed by the building of new cities. The channels of communication are vital to man's needs, and most cities are strategically located in this respect. There are very few good sites for cities not already preempted. A new system of air transport might conceivably bring about considerable changes in the distribution of population, but air transport will probably adjust itself to, and become coordinated with, existing development rather than cause any fundamental redistribution of population per se.

If the creation of new cities cannot be expected and if the future growth of urban population is definitely restricted, what changes, if any, can or should be anticipated in the present form of the American city?

The simple form of the city will not be changed. There will still be a main business center, industries located along the transportation routes or adjacent thereto, and residences in adjoining areas. Where there is lack of control of growth in the interest of unity and balanced design, there will be over-concentration of development at certain centers in response to induced speculative demand. As a reaction to such over-concentration there will be a spreading out of individual areas of development, particularly of business and industry. This in turn will force expansion of residential areas to an unusual extreme, particularly when induced by speculative demand. "Balanced design" should therefore be the desired objective. This can be obtained only by comprehensive planning. Balanced design requires limiting the area of growth so as to make it proportionate to probable growth. It means a limitation of over-concentrated development, such as skyscrapers in business districts or over-crowding of land by apartment houses. It means less subdivision of land into building lots on the outskirts of cities. It means more planning for control of all these things, in addition to widening streets, providing more park space, and building a civic center. City plans have always suggested such controls, but lack of public understanding and interest in such matters has caused them to be ignored in favor of piecemeal improvements, especially where the latter furthered the induced speculative demands.

UNNECESSARY CROWDING OF LAND, APPROXIMATING ONE THOUSAND PERSONS PER ACRE

There Is No Such Shortage of Land as Would Warrant This Congestion, Which Leads to Poor Citizens and Unsound Cities

EXAMPLE OF LACK OF BALANCED DESIGN

Almost all cities lack a policy of control, and especially a policy recognizing that the total area normally available for different property uses is quite limited. Such a policy of control is indispensable for sound planning. As an illustration of the significance of these factors, the conditions in St. Louis County, Missouri, might be cited. The city of St. Louis, which is not within the county, has a population of approximately 820,000, and its area is 62 sq miles. It is not a congested city—in fact, it is of fairly well-balanced design. For the past 20 or 30 years, population has spread out into county suburban areas more or less at random, with the result that today 200,000 people are attempting to urbanize an area of possibly 240 sq miles outside the present city. The density of population in this county area is now about one-sixteenth that of St. Louis, although in certain small areas it is already as dense as in the central city. While several cities and towns have been incorporated, there is much unincorporated area in which there is no building code, fire law, health department, or many other needed services.

To attempt to provide adequate public services for this great area in St. Louis County appears to involve prohibitive costs. A recent bond issue for roads amounted to $7^1/_2$ per cent of the total assessed valuation of property. The suburban resident has temporarily secured an ample standard of open space, but his costs will sooner or later exceed those in the city. One hundred county residents and an equal number of city dwellers lost their lives in a recent epidemic which originated in the partially improved land in St. Louis County. This represents another form of unnecessary

SMALL HOMES IN THE COUNTRY CLUB DISTRICT OF KANSAS CITY, MO.

Attractive Moderate-Priced Housing with Individual Home Ownership Is Possible in Large Cities and inexcusable waste that results from lack of adequate plans and the means for enforcement of such plans. The net result of such an inadequate, unbalanced process of urbanization is increased costs for everybody and even a general lowering of the average standard of living conditions if the whole population of the total area of urbanization is considered.

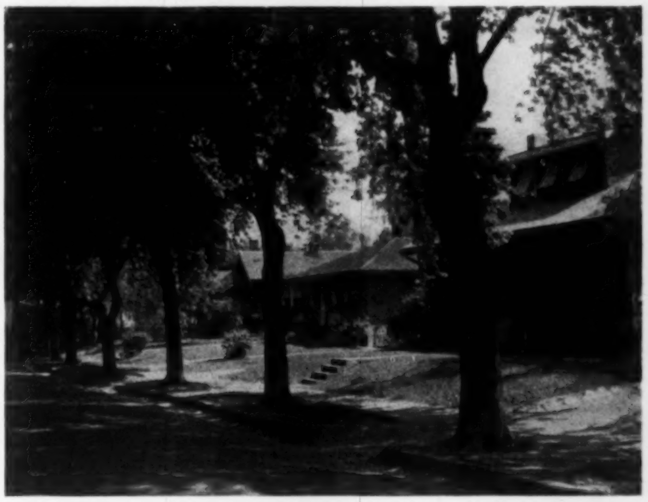
NEED FOR DEFINITE URBAN LAND POLICY

Decentralization which merely involves abandonment of existing cities or parts of cities and offers no social and economic concept of an equal or higher standard for the city as a whole, is unworthy of consideration. Until some sound method of decentralization is proposed, we can best devote our attention to the correction of bad practices attendant upon the otherwise sound form of the city. The present form of the city is entirely sound, current troubles being due to the manner in which the city has been exploited. America has passed the frontier stage in urban development as truly as it has in national development. Thus our future policy must be that of conservation as opposed to ruthless exploitation.

MEASURES NEEDED TO BUILD SOUND CITIES

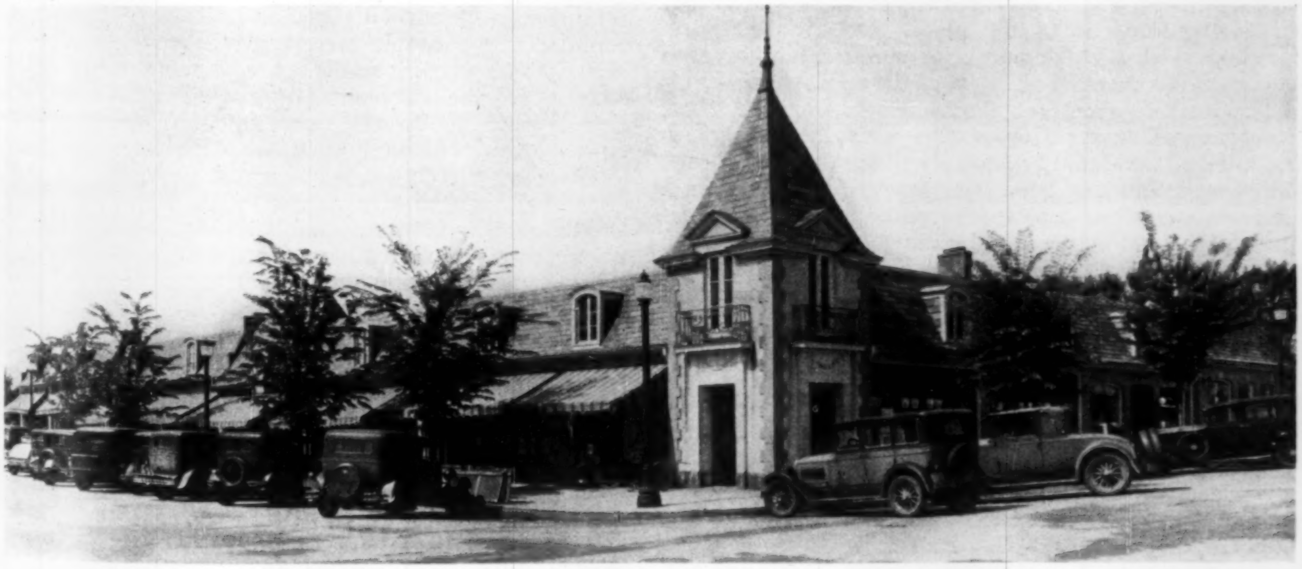
The measure most needed to bring about social and economic stability and strength throughout the whole urban structure is the official adoption of comprehensive city, county, or regional plans. Our city planning work has been ineffective because of inadequate enforcement. It is futile to expend large sums of money for comprehensive city plans and then fail to give them official sanction. The Standard City Planning Act should be adopted substantially in its present form in every state. Each city should prepare, adopt, and follow a comprehensive city plan, revising it from time to time as changing conditions necessitate. Where urban growth continues beyond the municipal boundaries, there should be an official plan adopted by the county or regional government.

Establishing sound cities will also necessitate a revision of zoning ordinances. Most zoning ordinances were prepared primarily with a view to preserving the more desirable residental districts. There was no recognition of the law of supply and demand in urban real estate. It was expected that the rapid growth of cities would continue indefinitely. The result of all this has been that our zoning ordinances are badly out of scale with social and economic needs. The older residence districts have been inadequately protected, and unnecessarily large areas have been zoned for industry and for commerce. Speculative practices have resulted in still further destroying the effectiveness of zoning plans by constantly changing portions of the few remaining protected residential areas. There can be no well-ordered, soundly developed city structure under such policies. Industry does not expand over great areas; neither does commercial property. Where three classes of property use cannot be expected to absorb more than 10 or, at most, 15 per cent of a city's area, it is absurd to set aside 25, 40, or 50 per cent of the city's area for such purposes, particularly when so doing deliberately invites deterioration and blight. Each use should be more closely confined in accordance with reasonable standards and normal expectations of growth. In addition, a policy of gradually exterminating non-conforming uses should be adopted.



A Well-Planned Subdivision Which Has Maintained Its Character for More Than 25 Years

New Construction Is Now in Progress Here as the Result of a Sound Urban Policy



Stores in Residential Sections of Kansas City, Mo., Situated at the Intersection of Main Thoroughfares

This Arrangement Is Preferable to Scattering Them Along the Streets

Only in this way can the stability of present values be hoped for, or a sound business basis be laid for the creation of new values.

Slum areas should be reconstructed. Apart from the desirability of providing work in the present emergency, slums should be destroyed and new housing built as a matter of sound economic as well as social policy. People have escaped the slums whenever possible because the buildings are obsolete and unsanitary, and because there is insufficient light, air, and open space. Since it cannot be hoped that the slum will be absorbed for commerce and industry, and since such areas are too large to be converted into parks, some other use must be found for these areas. The slum is usually a logical location for low-cost residences because it is close to centers of work. Reconstruction is the most logical solution of this troublesome problem.

SMALL PARKS HELP MAINTAIN THE CHARACTER AND STABILITY OF RESIDENTIAL AREAS

An attack should be made on the problem of blighted districts. Proper rezoning of our cities will automatically bring about a revitalization of blighted residential areas. Where there is now only a remote prospect of resale for commercial use, proper rezoning will indicate either the validity of a prospective commercial or industrial use, or the necessity for higher standards of maintenance based on permanent residential use. Pending the time when large-scale reconstruction of each blighted area becomes logical and necessary, various forms of neighborhood rehabilitation can take place. Only by such a return to reason can we again bring stability and strength to the development of all parts of the city structure.

The federal government has wisely created a Federal Emergency Housing Corporation with full powers to acquire land and build low-cost dwellings on a large scale. Only through such an agency empowered to operate on a large scale can the gap be bridged between past inadequate piecemeal methods of building and the large-scale undertakings that are now needed to demonstrate the desirability and feasibility of low-cost neighborhood-unit construction. It is to be hoped that the Federal Emergency Housing Corporation can soon construct 10 or 20 genuine, well-planned, large-scale, neighborhood-unit projects in as many cities. It will be a lesson worth all the cost involved.

SUGGESTED POLICIES

While definite policies appear undetermined as yet, certain suggestions for improved standards may be made:

1. Projects should be very definitely an integral part of the comprehensive plan of the city in which they are located. A division of city and community planning could well be established in the Federal Emergency Housing Corporation since the federal government is the present active agent for slum clearance.

2. In order to avoid the difficulties of remote control by the federal government, local housing authorities should also be created to construct, manage, and operate properties. Such local authorities should be thoroughly representative of the finest leadership in the community—civic, charitable, industrial, and commercial. Each project should be so managed that only those tenants would be admitted who were positively known to be in the lower-income group and worthy of admission on grounds of moral and financial responsibility.

3. Buildings should be designed and equipped to provide decent living conditions for the lower-income group of our population instead of being constructed merely to compete with other types of housing which are more distinctly within the field of private construction. This is a matter for careful study by each city. Projects should return in taxes to the local municipality a sum equivalent to the taxes heretofore normally collected in such areas. There is no justification for the taxation of new construction as such. The cost of normal public service, such as water and lighting, should also be paid by the project.

4. Rentals should be determined on as nearly a self-liquidating basis as possible. The rent schedule should be determined only after careful study in each particular case and, from time to time, should be subject to revision based on economic conditions. Since we already subsidize the slums, it is only reasonable that a subsidy should be provided for new housing to replace them. However, this subsidy should be no more than sufficient to meet the differential in cost warranted by the economic condition of the tenants.

ENLISTING PUBLIC INTEREST

Can we really build good cities? Good plans will be carried out only to the extent demanded by an enlightened public interest. Are the present financial problems of American cities sufficient to arouse citizens to a realization of basic causes? Can sufficient public interest be sustained and organized to acquaint all citizens with these problems and the measures which must be undertaken to build sound cities? Will the end of the depression and a return of normal business conditions lull our citizenry into its former state of complacency and self-interest, whereby the welfare of the city as a whole is neglected and each citizen believes or hopes that he will eventually escape the city?

Unless we deliberately wish to invite economic collapse and social disintegration, we must learn to organize as effectively for civic achievement as we have heretofore organized for commercial and industrial achievement. Our cities lack unity and balanced design, because there is no organized public opinion demanding something else. While cities were small there was little need for civic unity. With increasing growth and complexity of arrangement, however, there is an ever-growing need for united effort and constructive action to preserve unity and balanced design of the city. Our past failure to plan satisfactory cities has been due to our inability to act in concert for the common good.

In recent years one or two cities have succeeded in forming an organization sometimes known as a "chamber of civic affairs" or a "council of civic needs" for purposes of centralization of effort in the field of civic affairs. Only through such an organization is it possible to organize the public interest and build genuinely good cities.

Design of the Field Building, Chicago

Deep Foundations and Extra-Heavy Bank Vault Construction Are Features

By Magnus Gundersen

Chief Structural Engineer, Graham, Anderson, Probst and White, Architects, Chicago, Ill.

Situated in the heart of Chicago's famous loop district, the Field Building rises 44 stories to a height of 535 ft. About 22,500 tons of structural steel, of which approximately 10 per cent was silicon alloy steel, went to make up the skeleton. Columns are carried upon concrete caissons going down to rock at depths of from 80 to 100 ft, or in a few cases, resting upon hard clay. The latest type of cooling, dehumidifying and ventilating equipment provides conditioned air for the lower floors. Structural steel, reinforcing rods and electrical alarm wires surrounding the security vault in the basement make the latter as nearly impregnable as the present state of the art will permit. These are a few of the numerous interesting features of the building described in a straightforward manner by Mr. Gundersen in the following article.

One of the most prominent sites in the financial district of Chicago is occupied by the Field Building, completed by the trustees of the estate of Marshall Field in 1934. This building stands on the north side of Adams Street, extending from La Salle Street to Clark Street. This site was formerly occupied by three buildings: The 12-story Home Insurance Company building, believed to be the first skyscraper of steel skeleton construction; the 5-story Field-Glore and Company building, originally the Edison Company's office building; and the 12-story Standard Trust Company building, also of steel skeleton construction.

Because of the dates of expiration of the leases on the former building sites, it was necessary to construct the new building in three sections. Operations for the first section were started November 4, 1931, at the west end of the site, on the space formerly occupied by the Home Insurance Company building. This section is four bays wide and 23 stories high. The second section, adjoining the first section, was built two bays wide and 23 stories high. The remaining part of the building comprises the third section. The date of completion for the whole was May 31, 1934.

The building rises 44 stories above the street level, with three basements under one part and two basements under the remainder. The area of the basement is 61,750 sq ft. Frontage of the building on Adams Street is 325 ft, and on La Salle and Clark streets 190 ft each. The main part of the building is 23 stories high and covers the entire site for the four lower stories. Above the fifth floor, the floor areas are reduced by courts, as indicated in Fig. 1. Centered on the axes of the building and rising above the main structure is the 21-story tower, which is 165 ft long by 70 ft deep (Fig. 2). The building contains approximately 20,000,000 cu ft. The gross floor area is 1,400,000 sq ft, of which 1,000,000 sq ft is rentable.

The architectural style is that known as the "vertical skyscraper design," which has had a popular development within the past decade. This design seems to be more appropriate for tall buildings than the classical types formerly used. It also has the advantage of economy in construction and in maintenance through the elimination of heavy cornices, which require constant maintenance and are also a possible source of danger. For the full height of the first story the building is faced with black granite. This also plays an important part in the architectural treatment of the street entrances, where it is carried up to a height of four stories. The rest of the building facing is of Indiana limestone, except for the spandrel facings and window frames, which are of aluminum. Horizontal expansion points are provided in the stone facing at the level of the window heads in each story to prevent the stone from being crushed or pushed out of place by contraction or elongation due to temperature changes and variation of stresses in the columns.

General View of the Field Building

Although the building is primarily for office purposes, provision has been made for banking space in the lower stories and for shops in the ground and basement stories. The first basement is also occupied by a security vault, and the second and third basements are largely taken up by utilities. The forty-fourth floor is also devoted to utilities.

In the two lower basements, space has been provided for complete mechanical equipment for heat and refrigeration. Four boilers with a total capacity of 1,500 hp have been installed, and space has been reserved for three additional boilers. Coal is now being used for fuel, but twelve 4,500-gal tanks have been installed in case oil is substituted. In addition, provision has been made to receive steam to be supplied from an outside source. Coal is now brought into the lower basement through a branch tunnel connecting with the Illinois Tunnel Company's underground system.

AIR-CONDITIONING AND ELECTRICAL DISTRIBUTION EQUIPMENT

Air-conditioning equipment is provided for cooling, dehumidifying, and ventilating the four lower stories and the first basement. The equipment is of sufficient capacity to:

1. Cool the air-conditioned areas to a temperature not exceeding 74 F in weather having a dry-bulb temperature of 85 F or a wet-bulb temperature of 73 F.
2. Maintain a relative humidity in these areas not exceeding 50 per cent when the maximum wet-bulb temperature of the outside air entering the system does not exceed 73 F.
3. Control automatically the dew point or vapor pressure of the air leaving the dehumidifier within 1 F of the point for which the regulator is set.
4. Control automatically the dampers and valves connected with the room-temperature regulators, between full-open and full-closed, with a variation in temperature at the regulators of 2 F or less.

MAIN LOBBY, SHOWING MARBLE AND ALUMINUM TRIM

5. Maintain not less than 50 per cent relative humidity in the conditioned areas during the heating season. Provision is also made to heat the basement to a temperature of 70 F in zero weather.

The refrigerating equipment consists of three 250-ton units, located in the third basement, arranged to cool water in a storage tank. The chilled water is pumped as required to the ventilating units located in the second basement, second story and fourth story, returning by gravity to the third basement for recooling. The foundations of the compressors for the air-cooling system are isolated from the building proper by expansion joints to prevent the transmission of vibrations and sound throughout the structure.

Electricity is obtained from the local power company in the form of 12,000-v, 3-phase, alternating current. The supply comes in from two different sources over four feeders, any two of which have sufficient combined capacity to carry the entire building. Current is transformed down to working voltages in four transformer vaults, located in the basement and in the fourth, twenty-fourth, and forty-fourth stories. The high-tension electrical riser is suitably protected to avoid fire and personal hazard.

The main low-tension distribution is effected through four sets of risers in the main block of the building, connected to two in the tower. Each of these risers consists

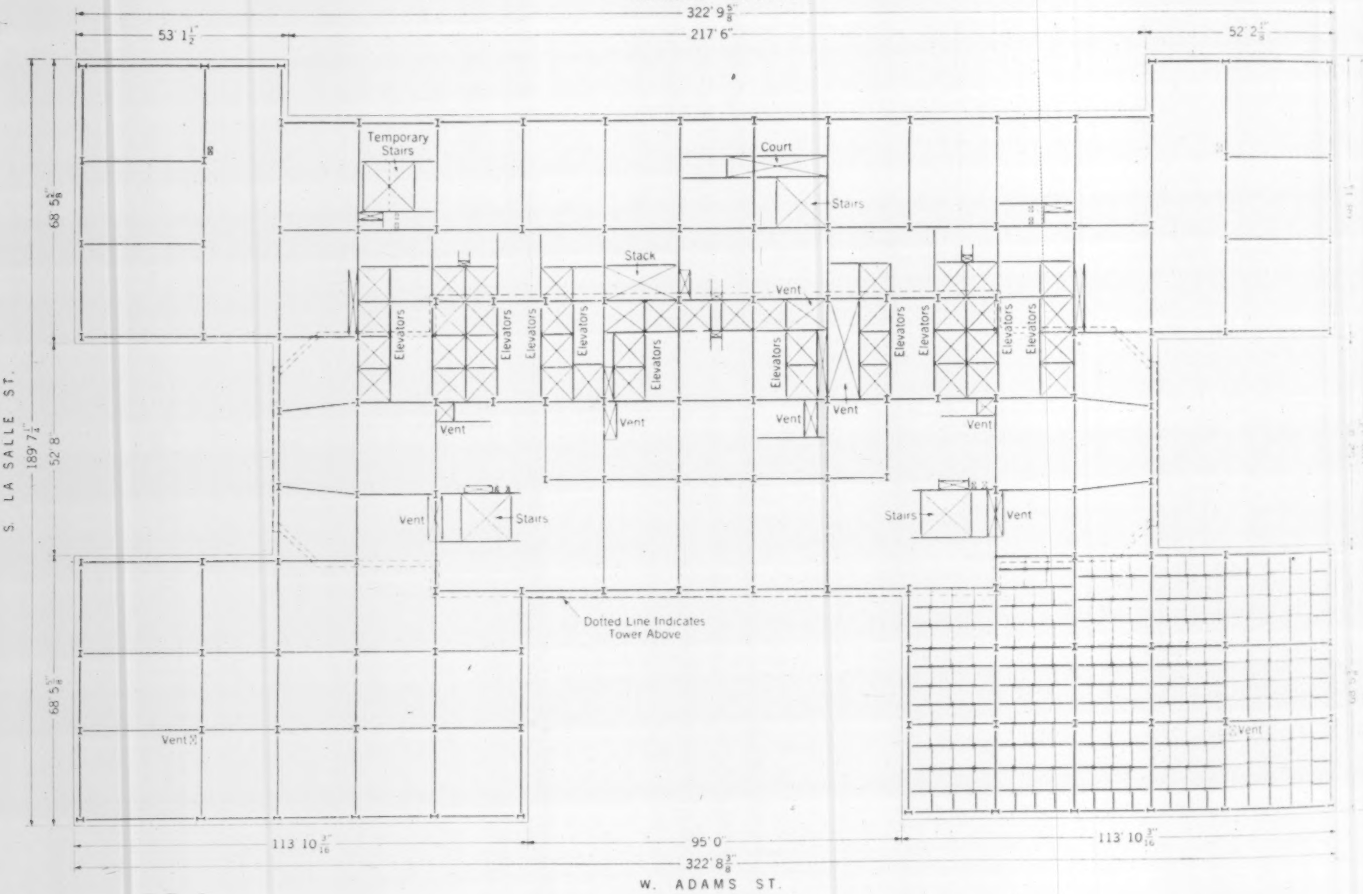

MARBLE COURT
322' 9 5/8"
53' 1 1/2"
217' 6"
52' 2 1/2"
Temporary Stairs
Court
Stairs
Stack
Vent
Elevators
Elevators
Elevators
Elevators
Elevators
Elevators
Elevators
Elevators
Elevators
Elevators
Vent
Vent
Vent
Vent
Vent
Vent
Stairs
Stairs
Vent
Dotted Line Indicates Tower Above
Vent
Vent
S. LA SALLE ST.
189' 7 1/4"
68' 5 5/8"
52' 8"
68' 5 5/8"
113' 10 3/16"
95' 0"
113' 10 3/16"
322' 8 3/8"
W. ADAMS ST.

FIG. 1. FLOOR PLAN OF FIELD BUILDING

Framing Plan for Sixth to Twentieth Floors. Silicon Steel Was Used in the Heavier Columns, With Silicon Steel Cover Plates Where Required

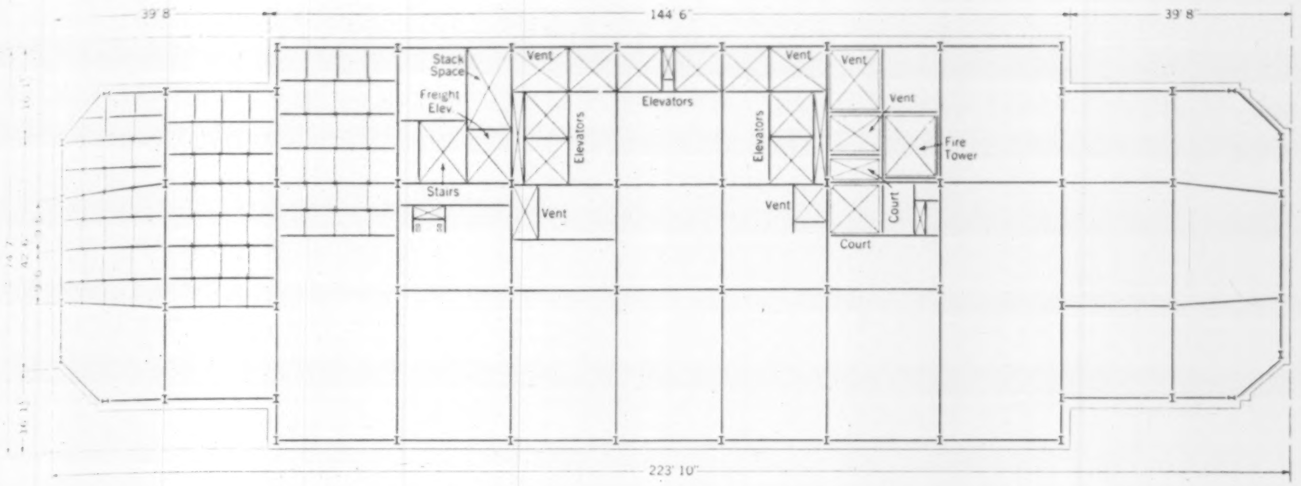


FIG. 2. FLOOR PLAN OF TOWER, FIELD BUILDING

Framing Plan for Twenty-Seventh to Forty-Second Floor. Wind Load of 30 Lb per Sq Ft Was Used on All Tower Surfaces and Was Transferred to Main Structure at Tower Base Through Beams and Floor Slabs

of four 4-in. aluminum channels suitably braced and covered by an insulating enclosure. All the risers are continuous and are fed from all four vaults, thus forming what has been referred to as an "interior vertical network." The local distribution panels were installed on each floor immediately adjoining and connected to the nearest riser.

GENERAL DESIGN OF BUILDING

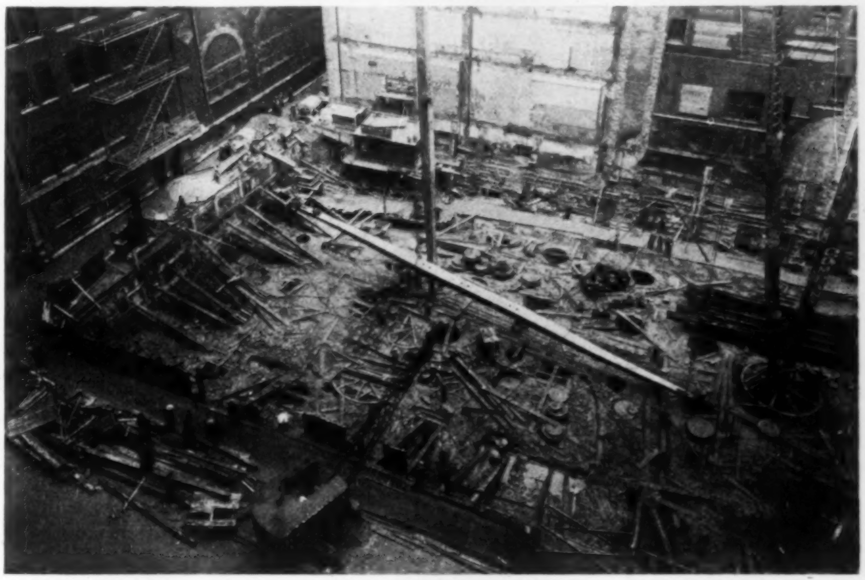
In general, the building is a steel frame with flat tile arch floors. However, all the basement floors are of reinforced concrete on steel framing, as are also the twenty-third, forty-third, and forty-fourth floors. It is of interest to note here that the numbers used in this article to designate the floors are not those applied in the building. Since many tenants dislike the number 13, no floor has been designated by that number. This means that the floor numbers used in the building are one greater than the actual on the fourteenth floor and above.

Concrete for the floors was mixed in the proportion of 1:2:4. In the basement floors, the aggregate was broken limestone, but in the three upper concrete floors a special type of light-weight aggregate was used. The office floors have a wood finish with aerated concrete fill poured after the sleepers were in place to give firmness. The latter weighs 48 lb per cu ft and has a crushing strength of 300 to 400 lb per sq in. The corridors have terrazzo floors on stone-concrete fill, and the main lobby and banking rooms have marble floors on stone-concrete fill.

The building was designed in accordance with the provisions of the Chicago building code, except for a special ruling by the Building Department permitting the steel to be designed for stresses recommended by the American Institute of Steel Construction.

The building is supported upon 166 concrete caissons (as shown in Fig. 3), of which number, 152 have diameters ranging from 4 ft to 8 ft 9 in. and extend down to bedrock at an average depth of 110 ft below the street grade. The remaining 14 caissons are 4 ft in diameter, belled out to 6 ft 6 in. or 8 ft, and are supported on hard clay (locally called hardpan) at a depth of 80 ft below the street grade. The latter caissons carry light loads from the columns under the court areas. Their bells are designed for a safe soil pressure of 12,000 lb per sq ft. In the caissons resting on rock, the concrete mix is 1:1:2, and in the belled caissons, it is 1:2:4. The sizes were arrived at by using the column loads in the lower story; no additional load was added for the weight of the caissons.

The retaining walls are built along the lot lines, with the exception of those in the first basement, which are located along the street curb lines to provide additional basement space. All retaining walls are of reinforced concrete except a section of curb wall along Adams and Clark streets. Here a gravity wall was already in place and in good condition. Although it was too shallow in depth for the new basement, by underpinning with mass concrete, it was possible to extend its depth from 14 ft to 19 ft below the street grade. The stone-concrete in the retaining walls is of 1:2:4 mix. The retaining walls



PREPARING FOR ERECTION, FIELD BUILDING

Setting Up Derricks Preparatory to Erection of Steel and all the basement floors directly supported by the soil are protected with integral waterproofing.

Equipment for handling and storing coal was located along the retaining wall on the north side of the building, which made it necessary to omit the floor construction in this locality. The result was an unsupported height of wall of 50 ft, the distance between the first floor and the boiler-room floor. To reduce the stresses in this part of the wall, a series of horizontal beams with supporting horizontal struts was introduced into it. The thrust from this wall is transferred at various levels by these struts to the columns, which in turn transfer it to the adjacent floors. A concrete slab takes the thrust at the trench floor.

ERECTING THE 21-STORY TOWER OF THE FIELD BUILDING

SILICON ALLOY STEEL EMPLOYED

In the building there are approximately 22,500 tons of structural steel, of which about 2,200 tons are silicon steel. The latter was used in the heavier columns, ordinary carbon steel being used for those ranging from 14-in. H-beams at 87 lb to 14-in. H-beams at 119 lb and up. Where a silicon H-beam did not provide sufficient cross sectional area, the area was increased by the addition of silicon plates. No cover plates were used on the carbon steel columns. At certain floors where columns were required to be offset, the upper sections are supported on large rolled beams or plate girders of carbon steel. In many cases rolled sections of silicon steel could have been used more economically, but carbon steel built-up girders were preferred on account of smaller deflections due to lower stresses. All beams and girders in the floor systems are wide-flanged rolled sections, designed generally for live loads of 50 lb per sq ft.

The wind bracing systems were designed, by the portal method, for a pressure of 30 lb per sq ft on the exposed surfaces of the tower and of 20 lb per sq ft on the main structure. Since the building was constructed in three sections, it was necessary to design the bracing for the first section as a complete and independent unit, and at the same time to provide for the additional wind loads that this section would have to resist when the other sections were added.

DESIGN OF BRACING SYSTEM

The first section was so narrow in the longitudinal direction of the building that the bracing system in this direction was required to be heavier than would have been necessary had the entire building been constructed as a unit. However, this heavier bracing made it possible to reduce correspondingly the amount of longitudinal bracing in the two sections constructed later. The bracing members were placed along the exterior walls as well as in several planes extending across the interior of the building in both transverse and longitudinal directions. At the base of the tower, that is, at the main roof (twenty-fourth floor), the wind loads from the tower systems are transferred through the floor beams and 6-in. solid reinforced-concrete slabs to the bracing systems of the main structure.

Web connections were designed either to carry the shear from gravity loads only or to carry the combined shear from gravity and wind loads at an allowable stress increased by 33 per cent. The flanges of the beams were connected to the columns with the now commonly used split-beam lugs. These lugs have only two lines of rivets in their flanges, one on each side of the web. The rivets joining the beam flanges to the lugs are either $^7/_8$ in. or 1 in. in diameter, and those joining the lugs to the columns range in diameter from $^7/_8$ in. to $1^1/_8$ in.

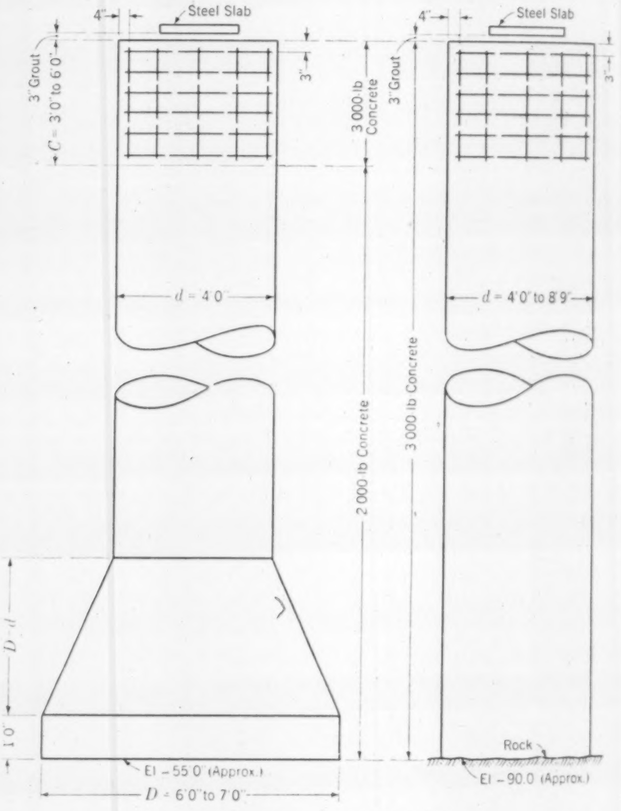


FIG. 3. DETAIL OF CONCRETE CAISSONS
Left, Belled Caisson as Used for Hardpan; Right, Cylindrical Caisson Resting on Rock

Of the various types of construction used in vault walls, one of the most modern designs calls for structural steel beams as part of the reinforcement. In the walls of the security vault, 8-in. H-beams are staggered on approximately 8-in. centers, as shown in Fig. 4. Attached to the beams, at right angles, near the outer face of the wall, are placed $^7/_8$-in. round rods on 12-in. centers. These beams and rods are enclosed in $1:1^1/_2:3$ stone-concrete having a total thickness of 21 in. The construction of the ceilings and floors is similar.

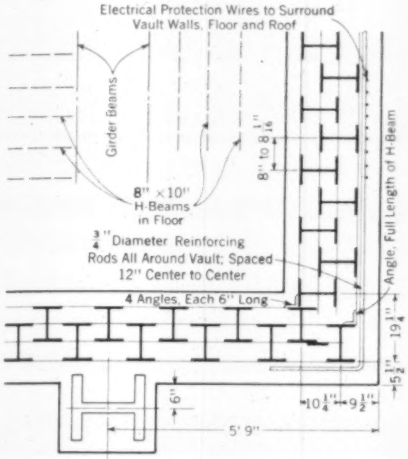

Electrical Protection Wires to Surround Vault Walls, Floor and Roof
Girder Beams
8" × 10" H-Beams in Floor
$\frac{3}{4}$" Diameter Reinforcing Rods All Around Vault; Spaced 12" Center to Center
4 Angles, Each 6" Long
8" to 8$\frac{1}{16}$"
Angle, Full Length of H-Beam
19$\frac{1}{4}$"
5$\frac{1}{2}$"
10$\frac{1}{4}$"
9$\frac{1}{2}$"
6"
5' 9"

Fig. 4. Detail Plan of a Corner of the Security Vault
Structural Steel Sections, Reinforcing Rods, and Electrical Protection Wires Were Built Into Walls, Floor, and Roof. Reinforcing Rods, 12 In. on Centers, Were Securely Fastened to the Structural Steel by Means of $^1/_2$-In. Hooks

Basement Arcade, Field Building
Indirect Lighting Avoids Use of Overhead Receptacles

The architects for the building were Graham, Anderson, Probst and White, of Chicago, who furnished the complete architectural and engineering designs and superintended the construction. The George A. Fuller Company was the general contractor, and the Bethlehem Steel Company furnished the structural steel.

View of Main Arcade, Field Building
Mirror Beneath Bridge Adds to General Bright Effect

Elevator Indicator Panel and Mail Box Duplicate Exterior Form of Building

ENGINEERS' NOTEBOOK

From everyday experience engineers gather a store of knowledge on which they depend for growth as individuals and as a profession. This department, designed to contain practical or ingenious suggestions from engineers both young and old, should prove helpful in the solution of many troublesome problems.

Models Illustrate Work of Soil-Mass in Foundations

By Prof. N. M. Gersevanov
Scientific Foundation Research Institute, Moscow, Russia
Abstracted by Fred L. Plummer, Assoc. M. Am. Soc. C.E.
Associate Professor of Structural Engineering, Case School of Applied Science, Cleveland, Ohio

Much valuable reasearch in soil mechanics has been accomplished during the last few years in Russia, in which work Prof. Gersevanov has been most active. This article, representing one phase of his investigations, has been briefed from a longer paper submitted to the Society. The original manuscript has been filed in the Engineering Societies Library, where it is available for study in detail by any one interested. American engineers are indebted to Professor Plummer for putting this material on the behavior of soil under load in a form which is believed to be of maximum value and usefulness.

ONE of the most common and at the same time most baffling of the problems encountered by engineers arises when it becomes necessary to predict how a large mass of water-enclosed soil grains will deform when subjected to load. The engineer who attempts to solve such a problem is apt to think in terms of capillarity, friction, cohesion, permeability; perhaps in terms of grain size and shape; possibly in terms of elasticity or plasticity. He is immediately confronted with the necessity of defining these terms—of providing a standard means of measuring the quantities as defined, and of determining the physical significance of each quantity. Such a task is not easy. In fact, most engineers find themselves confronted with so many variables, with so many constants and indices, that they have difficulty even in determining the qualitative influence of the various factors.

In Russian research work two types of mechanical models have been used to demonstrate the relative effect of several of the factors which influence the action of a soil-mass. It should be carefully noted that the following statements descriptive of these two types refer only to a mass of soil grains in which all the spaces between the grains are completely filled with water.

Consider the apparatus shown in Fig. 1, which consists of a cylinder, *AB*, containing a spring, *S*, supporting the tight-fitting piston *C*. The space between the piston and the bottom of the cylinder, as well as the capillary tube *G*, is filled with water. Let the spring represent the "skeleton" (grain structure) of the soil-mass; the water represent the ground water; and the meniscus at the end of the capillary tube, the combination of the menisci at the surface of the soil-mass. If the spring is in a free state, the water will be under normal hydrostatic pressure. Then the meniscus at the end of the tube will be flat or slightly convex if the end of the tube is lower than the elevation corresponding to the water head. This condition represents the soil in a liquid state.

ILLUSTRATING THE USE OF THE MODEL

For example, consider a cylinder 4 in. high, having a cross-sectional area of 16 sq in., with a capillary tube 0.004 in. in diameter. Assume the stiffness of the spring, which corresponds to the coefficient of consolidation of the soil, to be such that a force of 5 lb will compress it through a distance of 1 in. Suppose a load of 5 lb is now placed on the piston, forcing water out through the tube and compressing the spring 1 in. Next, remove the load from the piston. The spring will exert an upward force of 5 lb on the piston, tending to suck water from the tube. However, this is prevented by the formation of a concave meniscus at the end of the tube, the radius of which may be found to equal 0.00275 in., assuming the capillary tension of water as 75 dynes per cm. Thus the spring remains compressed and exerts an upward force of 5 lb on the piston. This force must be resisted by "tension" in the water. The apparatus now represents the soil in a plastic condition with the skeleton compressed by the capillary tension of the water included in the voids.

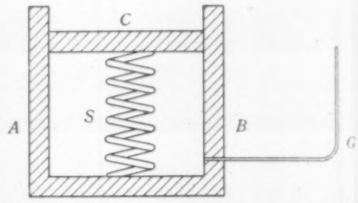


Fig. 1. Apparatus Used in Tests

Next consider what happens if a load of 2 lb is placed on the piston. Instead of compressing the spring further and forcing water through the tube, this load merely reduces the "tension" in the water and the meniscus at the end of the tube becomes flatter, with a radius equal to 0.0046 in. Thus the addition of load has not increased the compression in the spring (or the soil skeleton) but has merely reduced the capillary tension in the water.

SOILS WITH ELASTIC SKELETON

The same apparatus may be used to illustrate the shrinkage of soil with an elastic skeleton. Starting with a condition of no capillary tension (flat meniscus) assume that the water at the surface of the meniscus begins to evaporate. The meniscus becomes more and more concave as the water evaporates, increasing the capillary tension and compressing the spring until the radius of the meniscus equals that of the tube. This process represents the shrinkage of a plastic soil accompanied by compression of the skeleton and by a decrease in the moisture content together with an increase in cohesive strength.

If evaporation continues after the radius of the meniscus reaches its limiting value, the meniscus will retreat inside the tube, the spring will be compressed no more, and the point will have been reached where air begins to penetrate the soil, causing the soil-mass to pass from the semi-liquid into the solid state. In the example just given, this transition stage would be reached when the spring had been compressed to such a point as to correspond to a total force of 6.87 lb. The volume of the evaporated water would then equal 22 cu in. This volume of evaporated water (corresponding to the "number of plasticity") which represents the change in volume of the soil-mass, obviously depends on the diameter of the capillary tube as well as on the coefficient of elasticity of the spring.

If the entire apparatus is now immersed in water, water will be sucked through the tube until the spring has returned to its original position, provided the material of the spring is perfectly elastic. If such is not the case, then the volume of water sucked in by the apparatus will be less than the volume that was evaporated. Thus the "number of plasticity" for soils, determined during shrinkage of the soil, will frequently be larger than when determined during the swelling.

If the soil skeleton is very rigid, the "number of plasticity" will equal zero, and such a soil will pass directly from the liquid to the solid state. The same model will represent this type of soil if the spring is replaced by a rod having a cross section of, say, 0.16 sq in. If the modulus of elasticity of the rod equals 14,000,000 lb per sq in. a force of 6.87 lb would shorten this rod 0.0000123 in., corresponding to a total volume of evaporated water equal to 0.0002 cu in. as compared to 22.0 cu in. for the preceding example. This later volume is so small in comparison to the first that it may be considered as zero. It may be noted also that in the first case considerable time will be required to suck the large volume of water back into the cylinder, thereby relieving the capillary tension, whereas this will take place almost instantaneously in the second case. Thus a mass of sand grains which form a very rigid skeleton and will resist heavy exterior loads, immediately lose their so-called "cohesion" when immersed in water, and may be washed away easily by a stream of water with low velocity. At the same time a similar mass of clay grains, with an elastic skeleton, must be subjected to the action of water for a long time before the particles can be separated from the mass and washed away.

SOIL SAMPLES OF UNDISTURBED TYPE

A study of the two models is illuminating in connection with soil samples of the "undisturbed" type. Consider two soil samples taken from tests pits of the same depth, one soil having an elastic skeleton, represented by the first model, while the other soil has a rigid skeleton, represented by the second model. Both soil samples (and the corresponding models) are to carry the same initial loads, representing the weight of the overburden. When this load is removed, the capillary tension and the compression in the skeleton of the second soil will be immediately released, while the compression in the skeleton of the first soil can only be released after a long time. If both samples are removed from water, the compression in the skeleton of the first sample will be retained indefinitely by the formation of menisci unless the compression is greater than the maximum capillary force, in which case the menisci would be pulled into the soil, allowing air to follow until equilibrium was attained.

Thus, if of two soil samples removed from test pits or borings, one is in a liquid state while the second seems to be a cohesive soil, it can only be concluded that the first has a rigid skeleton while the second has an elastic one. In all probability, and contrary to first impressions, the first soil is the more reliable, since the rigid skeleton means less consolidation under load and a greater angle of internal friction. It should also be noted that the presence of air in such samples does not necessarily indicate the presence of air in the soil, but rather that the load on the undisturbed soil exceeded the value of the maximum capillary tension corresponding to the mean diameter of the voids.

These and similar models may be used to study and demonstrate many other relations having to do with the cohesion, friction, and shearing strength of any soil-mass.

Diagram for Determining Maximum Deflections of Continuous Girders

By JEROME W. HOWE, M. AM. SOC. C.E.

PROFESSOR OF CIVIL ENGINEERING, WORCESTER POLYTECHNIC INSTITUTE, WORCESTER, MASS.

A DIAGRAM which facilitates computation of the maximum deflections in continuous girders under uniformly distributed loads was published by Dipl. Ing. E. Reichdorf in *Der Bauingenieur* for June 8, 1934. The diagram is reproduced here as Fig. 1, with ordinates modified to make it directly applicable to English units. It is applicable only to spans in which the moment of inertia is constant across the span.

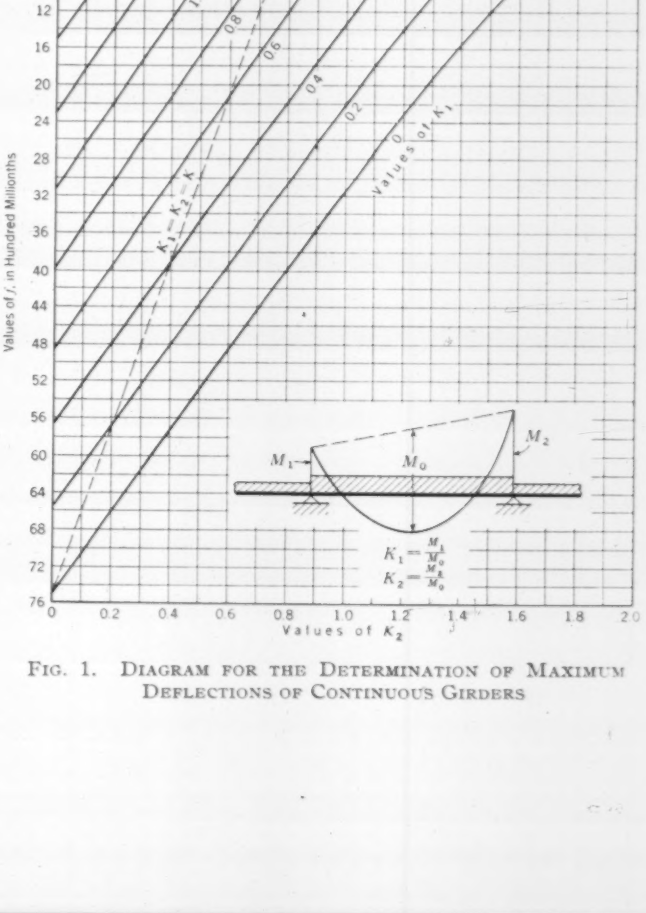


FIG. 1. DIAGRAM FOR THE DETERMINATION OF MAXIMUM DEFLECTIONS OF CONTINUOUS GIRDERS

Designating as M_0 the maximum positive bending moment $\left(\frac{wL^2}{8}\right)$ which would result if the span under consideration were simply supported, and as K_1 and K_2 the ratios of the two actual negative end moments in the span, respectively, to M_0, Mr. Reichdorf proceeds by the moment-area process to derive an expression for $EI\delta$ containing these terms. He then differentiates the value of δ with respect to $\frac{x}{L}$ and equates to zero, obtaining thereby an expression for $x_{max\delta}$ as a cubic equation. The evaluation of the root is not given, but the author has substituted it for x in the expression for $EI\delta$, and derives finally an expression $\delta_{max} = \frac{fwL^4}{I}$, in which f denotes a function of K_1, K_2, and E. The diagram (Fig. 1) expresses this function graphically, for $E = 30{,}000{,}000$ lb per sq in.

It is of course first necessary to determine the moments at both supports of any span under investigation. From these support moments, M_1 at left and M_2 at right, K_1 and K_2 are computed. The corresponding value of f is then read from the diagram and the maximum deflection computed from $\delta_{max} = \frac{fwL^4}{I}$ (in which w is in lb per lin ft, L in ft, I in in.^{4}, and δ in in.).

If another material than steel is to be used, for which E_e denotes the modulus of elasticity, then the result obtained as above indicated should be multiplied by the ratio E_s/E_c.

It is of course possible to invert this expression and obtain a value for I to reduce the maximum deflection to any desired value of δ/L. However, since moments in continuous girders are obtained in most cases by use of a known or assumed value of I, it is evident that the adoption of a different I than that at first assumed will necessitate revision of moments, and new values of K_1, K_2, and f, so that the determination of I must be by the cut-and-try method.

If both end moments are equal ($K_1 = K_2 = K$) or if they do not differ greatly and $\frac{K_1 + K_2}{2}$ is put equal to K, then by entering the chart for this value of K on the dash line, the corresponding value of f will give the correct deflection in the first case and the nearly correct deflection in the second case.

Our Readers Say—

In Comment on Papers, Society Affairs, and Related Professional Interests

Comments on Engineering Fallacies

DEAR SIR: The careless use of the beam theory, pointed out in Mr. Fleming's article, in the May issue, entitled "Engineering Fallacies More or Less Common," has already been amplified in the August issue by Professor Beyer. The error that the latter points out is a treacherous one because it leads to correct results in the most common cases that arise.

An interesting sidelight suggested by the original article and the discussion is the confusion of sign conventions. The illustration from the discussion by Professor Beyer is reproduced here, for reference, as Fig. 1. His statement that M is assumed negative leads to the result that y and i_x are positive. If they are thus considered, his mathematics is self-consistent and correct. It is the general practice in American schools, however, to consider M as positive when it produces compression in the upper fibres of the beam. The elastic curve can be obtained from the load curve by successive integrations through the shear, moment, and slope curves. Starting with a downward vertical load as negative (acting in a negative direction), the signs of each curve follow. This series of curves is consistent with the practice of analytic geometry and with the accepted convention for shear and moment. In the case of the left half of the uniformly loaded beam we have the ordinates of the load curve negative, the shear positive, the moment positive, the slope negative, and the deflection or elastic curve negative. The use of M as negative leads to no confusion if all signs of these curves are changed. If, however, M is taken as positive, the equation $y = -\int_0^x \frac{Mxdx}{EI} + xi_x$, given by Professor Beyer, becomes $CC' = -A'A + A'A''$ where CC' and $A'A''$ are negative and $A'A$ is positive.

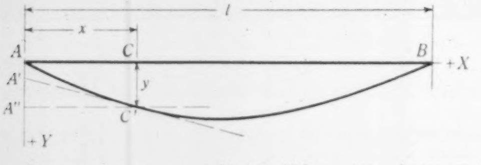


FIG. 1. REPRODUCED FROM PAGE 486 OF THE AUGUST ISSUE

The confusion referred to occurs in an attempt to maintain the positive sign for M and the conventional sign for shear, at the same time considering a load positive if acting downward and the ordinates of the deflection curve positive when measured downward. Usually the errors introduced are corrected as they are quite obvious, but if a consistent system is used the signs of each term follow automatically.

Discussions of a current paper in PROCEEDINGS ("The Shear-Area Method") illustrate the possible misunderstandings which may be involved when the system of signs is unusual.

J. CHARLES RATHBUN, M. Am. Soc. C.E.
Associate Professor of Civil Engineering
College of the City of New York

New York, N.Y.
September 10, 1935

Tree Rings and Runoff in the Northwest

TO THE EDITOR: In discussing Mr. Harding's article, "Variations in Runoff of California Streams," in the September number, some investigations of long runoff records in the Northwest may be of interest. The longest stream-flow record in the Columbia River basin is that of the Columbia River at The Dalles, Ore., where continuous records have been taken since 1878. The period from 1919 to 1934 represents the lowest runoff for a period of 16 consecutive years that occurred on the Columbia River during that time. Of these 16 years there were only 4 in which the runoff was above normal. The wettest periods were from 1879 to 1888 and 1893 to 1904.

In an attempt to ascertain what variations in precipitation and runoff might have existed on the Columbia River watershed prior to 1878, some measurements of tree-ring widths have been assembled and are presented herewith in Table I. On account of the long series of years covered by these records they are shown by 10-year periods only.

Table I. Thickness of Tree Rings by 10-Year Periods as Percentage of Average for Period of Record Precipitation at Boise, Idaho, and Runoff of Columbia River at The Dalles, Ore., Shown for Comparison

Year	Fifield Tree*	Average of 4 Trees in Harney Basin	Average of 9 Trees from Snake River Plain	Precipitation at Boise	Runoff of Columbia at The Dalles
	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent
1601-10	102	...	...	...	...
11-20	102	...	...	...	...
21-30	91	...	...	...	...
31-40	91	...	...	...	...
41-50	110	...	100	...	...
51-60	108	...	83	...	...
61-70	87	...	90	...	...
71-80	108	...	97	...	...
81-90	110	...	106	...	...
91-1700	92	...	118	...	...
1701-10	78	...	114	...	...
11-20	87	...	100	...	...
21-30	99	...	100	...	...
31-40	64	...	92	...	...
41-50	70	...	109	...	...
51-60	74	...	105	...	...
61-70	74	91	103	...	...
71-80	76	89	105	...	...
81-90	66	108	102	...	...
91-1800	91	106	105	...	...
1801-10	70	124	98	...	...
11-20	70	104	95	...	...
21-30	81	96	112	...	...
31-40	101	88	96	...	...
41-50	96	68	85	...	...
51-60	117	103	102	...	...
61-70	125	118	109	...	...
71-80	156	101	112	114	...
81-90	110	108	109	100	106
91-1900	128	106	91	102	111
1901-10	137	115	96	93	99
11-20	105	96	94	103	94
21-30	...	87	79	89	87

* Record of the Fifield tree goes back to 330 A.D. Earlier part of record omitted here because of lack of space.

The longest record is that of the Fifield Juniper which was cut in March 1928. There are two principal long-time periods of under-average growth during the life of this tree—one from 770 to 1020, or 250 years, and one from 1690 to 1830, or 140 years. During 400 years from 1200 to 1600 the growth was above average except for short intervals. The deficient period from 1690 to 1830 corresponds in a general way with the period of deficiency indicated by Mr. Harding from records at Mono, Eagle, and Tahoe lakes.

All the trees measured grew at points where they received no moisture from the underlying water table. The ring widths, however, may have been affected by such factors as varying temperatures during the growing season, depth of soil, and extent of the root system, disease, and assymetrical growth, so it is a matter of personal inclination as to the weight to be given them as indicators of variation in precipitation during past years. Available records of precipitation at Boise and river runoff at The Dalles, are included in Table I for comparison.

It will always be a difficult matter to limit the development of small projects for the use of water during a period of years of abundant supply, but the larger and more costly projects deserve more serious consideration, from a water supply standpoint, than has often been given by the engineering profession in the past.

The usual procedure has been to use the runoff data during years of available stream-flow records and assume that similar conditions will occur in the future. The unsatisfactory results that have occurred during the past generation from the use of this method would indicate that irrigation and hydraulic engineers ought perhaps to apply a factor of safety to their water supply studies, similar to that used in other branches of the profession.

Stream flow on the Columbia River watershed has not yet begun to approach as near complete utilization as exists in California. When further development occurs it is likely that the flow will be somewhat equalized by holdover reservoirs of large capacity. On some of the tributary streams a limited amount of ground-water storage could be developed, although the cost of installing wells and pumping from ground water has so far been greater than the cost of developing additional reservoir storage. The last large storage development on the Snake River was the American Falls Reservoir (1,700,000 acre-ft) completed in 1926 at a cost of $4.50 per acre-ft. At the present time other storage developments are being considered on the Snake River and tributaries with a construction cost of $10 to $12 per acre-ft.

Lynn Crandall, M. Am. Soc. C.E.
Watermaster, Snake River, District 36

Idaho Falls, Idaho
September 2, 1935

Grading Materials for Earth Fills

Dear Sir: In his article, "Selecting Materials for Rolled-Fill Dams," in the September issue, Mr. Lee has performed a notable service to engineers in discussing the factors to be considered in examining materials for the construction of this type of dam.

Personal observations made many years ago on the priming of canal banks constructed by teams, indicated to me that where materials are reasonably well graded no trouble is encountered. But where the material is of uniform size and sufficiently fine to prevent free drainage—whether clay, sand, gravel, or rock—there is leakage with resultant sloughing on the outside of the bank. Except for the top 2 or 3 ft, satisfactory highway fills can be constructed of ungraded materials—sand, gravel, or rock—provided there is sufficient compaction, drainage, and lateral support to prevent excessive settlement.

It would appear that the following factors, in addition to those discussed by Mr. Lee, might well be considered:

1. Consolidation by weight, which can be determined by testing and which will become evident in the completed dam by the rate and amount of settlement. In addition to tests of normal material, consolidation tests should include tests of normal material with the introduction of water after a consolidation head equal to one-third of the height of the dam is reached. The weight of the fill itself tends to increase its density, with corresponding reductions in the voids and permeability. More information should be secured by engineers on the rate and amount of settlement of all dams constructed of earth and rock, both during and after construction.

2. Allowable percentages of colloidal and clay materials. An excess of fine materials often means a large capacity for water, which may result in excessive cracking and checking upon loss of moisture content and excessive settlement.

3. Ability of materials when placed in rolled-fill dams to adjust themselves to settlement without cracking or forming planes of lessened resistance to the percolation of water.

Concise and brief definitions of certain words or terms used by Mr. Lee and others would be of assistance to those interested in studying dams constructed of earth, whether by rolled or hydraulic methods.

In order that comparisons may be made quickly and with a minimum of effort, it is believed that gradation graphs should be in millimeters, with inches and sieve sizes shown at the top and the classifications—such as clay, silt, sand, gravel—shown across the middle of the sheet.

As it is practically impossible in the construction of rolled-fill dams to mix materials from several sources to secure a modified material having or approaching the ideal characteristics, it becomes necessary to determine the suitability of local materials by inspection and by laboratory tests, as suggested by Mr. Lee, Mr. Proctor, and others.

Fred D. Pyle, M. Am. Soc. C.E.
Hydraulic Engineer, City of San Diego

San Diego, Calif.
September 6, 1935

Alternate Solution for Unsymmetrical Vertical Curves

To the Editor: The formulas required for the calculation of unsymmetrical vertical curves, developed by Mr. Pavlo in the March issue, can be obtained more easily by taking advantage of the fact that the equation of a parabola with respect to a point of tangency as an origin, a tangent as an X-axis, and a vertical line as a Y-axis, is of the form, $y = mx^2$.

That the form of the equation does not change when referred to these axes can be demonstrated with the aid of Fig. 1. With respect to the rectangular axes $X-X$ and $Y-Y$, the equation of the parabola is $y = mx^2$; A and B are general points on the parabola with coordinates respectively x, y, and x_1, y_1, and the slope of the tangent at B is $2\,mx_1$, or $\tan\theta$. With respect to the axes $X'-X'$ and $Y'-Y'$ (through B) the coordinates of A are x', y'. From the figure,

$$x = x_1 - x'\cos\theta$$

$$y = y_1 - x'\sin\theta + y' = mx_1^2 - x'\sin\theta + y'$$

Substituting these values of x and y in $y = mx^2$, simplifying, and replacing $2\,mx_1$ by $\tan\theta$

$$y' = mx'^2\cos^2\theta = m'x'^2,$$

which is of the same form as the original equation.

In applying this to the problem of vertical curves, the ordinates are the vertical distances, or differences in elevation, between tangent and curve. Strictly speaking the abscissas would be measured along the tangent, but since the distance from station to station, along the tangent, is in a constant ratio to the horizontal station distance, the latter can be used in the computations.

In Fig. 2 we have given the two grades, g_1 and g_2, the P.C. and the P.I. The problem is to pass a parabolic curve through the point b, and to extend this curve to c, the station of the P.I., where it is to be connected to, and have a common tangent with, a second parabola which is in turn tangent to g_2. Let BcF be the common tangent, abc and cde the required curves, and d the point of highest elevation.

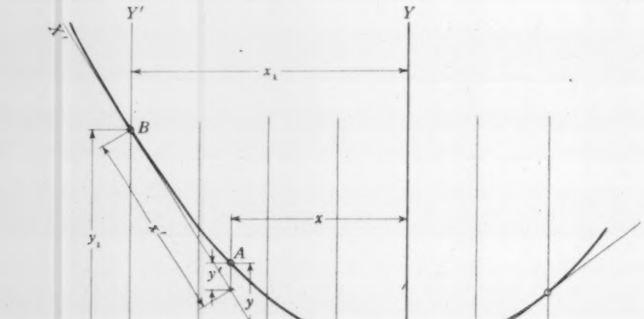


Fig. 1. Illustrating Change of Axis of a Parabola

The equation of the first parabola, abc, referred to the origin at a and with the tangent aC as an X-axis and a vertical line as a Y-axis is $y_1 = m_1x_1^2$. The equation of the second parabola with respect to the origin at e, with the tangent Ce as an X-axis and a vertical line as a Y-axis is $y_2 = m_2x_2^2$. Then m_1 can be obtained by substituting the known coordinates of b ($x = a$, $y = k$) in the equation of the curve; whence, $m_1 = \frac{k}{a^2}$ and $D = \frac{k}{a^2}\,l_1^2$.

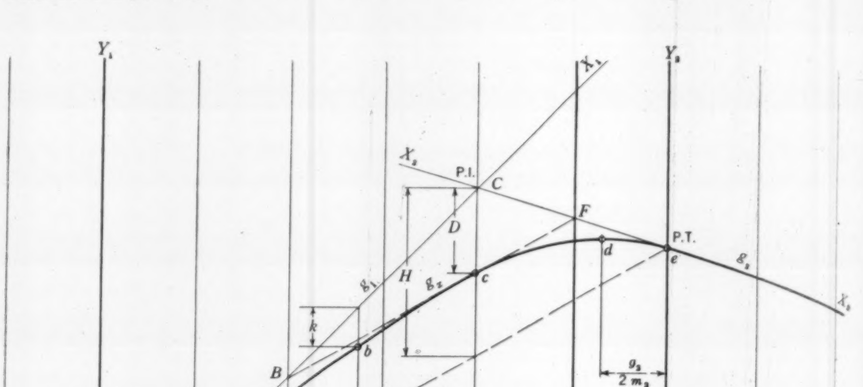


Fig. 2. An Unsymmetrical Vertical Curve

The slope of the tangent at c, with respect to g_1 as X-axis, is $2\,m_1l_1$; hence the slope (g_x) with respect to the horizontal is $g_1 - 2\,m_1l_1$. Also, since the horizontal projections of the two tangents to a parabola from any given point are equal, $aB = BC$, and $CF = Fe$. Hence BF is parallel to ae, $BF = {}^1/_2\,ae$, and $D = {}^1/_2H$. It follows that

$$l_2 = \frac{2\,D}{g_x - g_2} = \frac{2\,D}{g_1 - 2\,m_1l_1 - g_2}$$

For the second parabola m_2 can be found by substituting $y_2 = D$ and $x_2 = l_2$ in the equation $y_2 = m_2x_2^2$.

The highest point on the curve can be found by equating $\frac{dy_1}{dx_1}$ to g_1 or $\frac{dy_2}{dx_2}$ to g_2, whence $x_1 = \frac{g_1}{2\,m_1}$, or $x_2 = \frac{g_2}{2\,m_2}$. If a value greater than l_1 is obtained when g_1 and m_1 are used, it is apparent that the highest point is beyond c, and the formula for x_2 should be applied.

H. Bouchard, Assoc. M. Am. Soc. C.E.
Associate Professor, Geodesy and Surveying, University of Michigan

Ann Arbor, Mich.
September 6, 1935

Comments on the DeWitt Clinton

Dear Sir: I should like to comment on the reproduction of an original drawing of the locomotive, the DeWitt Clinton, which appeared on page 193 of the March 1935 issue of Civil Engineering. Some time ago the Transportation Library of the University of Michigan obtained a copy of a scale drawing of the DeWitt Clinton. This copy is reproduced in the accompanying illustration.

The following letter, written on May 3, 1876, by Mr. David Mathew, of San Francisco, Calif., transmitted the original drawing to James H. Pease, an official of the New York Central:

"*James H. Pease, Esq.*
"*Dear Sir:*

"This is the drawing of the Engine DeWitt Clinton drawn by me in 1831 while on the Mohawk and Hudson R. R. which I present to your Centennial Chat. This drawing will show the first cab or covering put upon an engine. As my drawing is torn and faded by the hand of time, you had better have some one copy it and send mine back to me, as it is a relic of the past and much prised by me. This drawing shows the engine as it was when run by me on the 9th day of August 1831 at the opening of the Mohawk and Hudson Rail Road.

"The first engine run in the State of New York.

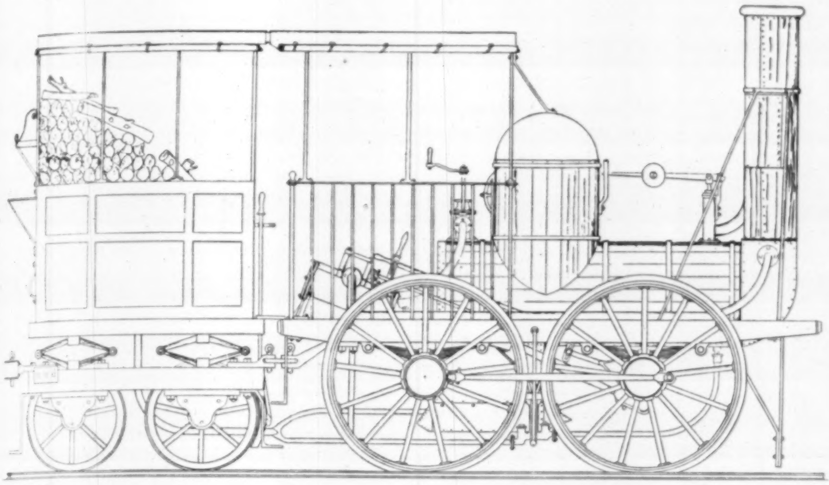
"*Yours truly*
DAVID MATHEW"

J. D. MacLean of Reading, Pa., had evidently been requested by Mr. Pease to make the copy here reproduced of Mr. Mathew's original drawing. On May 30, 1876, he forwarded the copy to Mr. Pease with the following letter:

"*James H. Pease, Esq.*
"*Dear Sir:*

"This is a correct copy of the drawing sent to you by Mr. David Mathew drawn by me, which I most heartily present to your great undertaking the Centennial Chat of progress. This drawing shows the steam engine in its infancy.

"*With much respect*
"*Your friend*
"D. J. MACLEAN"



SCALE DRAWING OF THE DEWITT CLINTON MADE IN 1831

Being deeply interested in the career of David Mathew, I was searching for information about him at the time the library acquired the drawing. From the address on his letter I knew that he was in San Francisco in 1876. Although I was not able to secure a great deal of information about him, I was fortunate in obtaining a drawing of the De Witt Clinton (here reproduced) as of that date. I have every reason to believe that this drawing is authentic. In that it differs somewhat from the wash drawing in CIVIL ENGINEERING, I do not consider of any great importance with reference to the authenticity of either drawing. It seems probable that the wash drawing was made before the scale drawing, which was drawn prior to the construction of the locomotive.

One of the interesting features of the wash drawing is that it contains no steam dome, while there is every evidence that the original did contain such a dome. Also of interest in connection with the drawing here reproduced is the fact that it shows a canopy over the rear of the locomotive while the model now owned by the New York Central contains no such canopy. There are other minor discrepancies.

JOHN S. WORLEY, M. Am. Soc. C.E.
Curator, Transportation Library
University of Michigan

Ann Arbor, Mich.
August 28, 1935

When Queen Victoria Greeted American Engineers

DEAR SIR: I am glad Mr. Kornfeld in his story in "Society Affairs," in the July number, has recalled the reception given to the members of the American Society of Civil Engineers by British engineers at the time of the Annual Convention in London in 1900. I was fortunate in being one of the American group, and look back on those days in and near London as notable in international hospitality.

But there is one phase of Queen Victoria's part in the visit to Windsor, not brought out by Mr. Kornfeld, which it seems to me added some charm to the occasion. Queen Victoria of course did not appear at the luncheon in the Orangery at Windsor Castle. But after the luncheon the American engineers were asked to range themselves along a nearby driveway in the castle park, which we did, with Mr. Wallace, and other officers of the British and American societies, at the head of the lines. Queen Victoria soon appeared seated in a small open carriage, with a lady beside her. The carriage stopped at the head of the procession, where the officers were presented. The Queen then drove slowly between the lines of waiting Americans, who were thus given an opportunity of noting close at hand her friendly face and smile—we were so close that the lady standing next to me, wife of a prominent American engineer, tossed a greeting card into the carriage, somewhat to my consternation. I feel that the simple and gracious manner of the Queen's approach is worthy of being added to Mr. Kornfeld's interesting story.

GEORGE R. PUTNAM, M. Am. Soc. C.E.

Dorset, Vt.
August 29, 1935

Effect of Earthquakes on Tall Elastic Structures

DEAR SIR: An important and timely contribution to the subject of "Earthquake Effects on Elevated Water Tanks" was made by Mr. Ruge in his article under that title in the August 1935 issue. Because of its general applicability, this article should receive the attention of those who wish to qualify as designers of structures that will resist earthquakes. It shows how difficult it is to formulate a rational method for use in designing "flexible" structures. That mere strength may not be as important as stiffness is clearly shown. This fact has been recognized by Naito and other authorities, particularly in relation to the formula, $F = Wa/g$. Ordinary wind-bracing connections are too flexible when the simple formula is used in the design, and also if great damage to the building is to be prevented when movements of considerable intensity occur.

The point that earthquakes are not forces but motions, so far as design of structures is concerned, is well taken. That earthquake motion within the destructive area is not, and does not resemble, the simple harmonic form is recognized. Future experiments using motions more nearly like those due to an earthquake should prove still more valuable. I was recently discussing this subject in Guatemala with a prominent engineer of that city. He stated that during the earthquake of 1917–1918 the tops of tall elastic structures moved in the form of a circle—not to-and-fro.

One question arises in my mind: Is the stiffness of the water tower the same for the two conditions, (*a*) with the bending in a plane parallel to a side, and (*b*) with the bending in a plane parallel to the diagonal of the square?

GEORGE E. HOWE, M. Am. Soc. C.E.
American Bridge Company

New York, N.Y.
August 19, 1935

Early Use of Rigid-Frame Bridges

TO THE EDITOR: In commenting on Mr. Hayden's article, in the August issue, it may be of interest to note that rigid-frame bridges, of structural steel and of reinforced concrete, were very much in fashion 30 and 40 years ago. Nearly every bridge designer of any standing built or hoped to build at least one bridge of that type. The most famous rigid-frame bridge at that time was the Stephanie Bridge over the Danube Canal at Vienna, Austria, which for many years was considered one of the most beautiful bridges in the world. It was built in 1885 and had steel girders of 200-ft clear span, of a depth of $^1/_{44}$ of the span at the crown and one-seventeenth of the span at the abutment, about the same proportions as advocated by Mr. Hayden.

In my *Architect's and Engineer's Handbook of Reinforced Concrete Construction*, published in 1904, are shown many pictures of the largest concrete bridges built up to that time. Nearly 50 per cent were of the rigid-frame type. In the first decade of this century a great many rigid-frame bridges were built also on this side of the Atlantic, from coast to coast and from Mexico to Winnipeg.

The most famous of all rigid-frame bridges is the reinforced concrete bridge of the Risorgimento over the Tiber at Rome, Italy, designed by Hennebique engineers in 1909. It consists of box girders of 330-ft clear span, 3 ft deep at the center and 36 ft deep at the abutment, making all laymen and even engineers believe that it was an arched bridge. It was, in fact, so designated in all technical papers of that time. The abutments rested on such poor ground that it was necessary to make them 80 ft long in the axis of the bridge and to support them by concrete piles. The lower slab of this box girder was only 8 in. thick at the crown and 20 in. thick at the abutment and was, of course, entirely inadequate to act as an arch of 330-ft span. That it really acts as a restrained girder can be seen from the deflection measurements of the official tests, made in May 1911. With a uniformly distributed load of 124 lb per sq ft over the right half of the bridge, the deflection at the center was 1.26 in., at the quarter-point in the loaded half 0.75 in., and at the quarter-point of the non-loaded half 0.63 in. In case of an arched bridge the deflection in the center of the span should have been much less than in the quarter-points.

Many of the older rigid-frame bridges were of the proportions mentioned by Mr. Hayden, namely, about $L/40$ deep at the center and $L/15$ deep at the abutments, and they were regularly designed for a bending moment of $wL^2/30$ at the center and $wL^2/10$ at the support, regardless of whether the base of the abutments was hinged or fixed. The respective theoretical moments for beams of that shape are about $wL^2/40$ and $wL^2/10$, respectively, and it was considered good practice to design the bridges for a much larger bending moment in the center in order to take care of the secondary stresses which mostly affect the center of the girder. Experienced designers wasted no time on the girder part of the bridge, but the design of the abutment was considered a much more serious problem and no affair for amateurs. A rigid-frame bridge of reinforced concrete is subjected to continual movements from temperature and moisture variation. The rigid frame causes the thrust to vary greatly between dead- and live-load conditions; it also produces wide variations in active and passive earth pressure.

Many rigid-frame bridges have very poorly designed foundations and do not have weight enough on the foundations to prevent sliding, especially on clay soils under flood conditions where the coefficient of friction may be only 0.25 or less. More than twenty-five years ago, this was the cause of serious trouble in certain rigid-frame bridges of considerable span in southern California, and many of the recently described rigid-frame bridges have no better footings.

I cannot explain why rigid-frame bridges were out of fashion in this country for about fifteen years. The establishment of highway commissions in most states took business away from the original concrete experts, and the bridge engineers of the new departments were so busy with small span bridges, generally built by local farmers, that there was no time left for the design of more scientific structures requiring contractors of much higher standing. Mr. Hayden certainly deserves great credit for having revived this beautiful type of bridge.

L. J. MENSCH, M. Am. Soc. C.E.
Civil Engineer and Constructor

Chicago, Ill.
August 16, 1935

Program of Emergency Public Works Requires Planning

DEAR SIR: The need for planning in the programming of emergency public works is rather a large subject, but Mr. Fox has covered it well in his article in the September issue.

Too often political expediency has taken the place of planning in programs of public works. It is encouraging to see that the Works Progress Administration has recognized the importance of planning in receiving applications under the Emergency Relief Appropriation Act of 1935, which is the $4,880,000,000 Appropriation Act.

In Circular No. 1 of the Works Progress Administration, entitled "Preliminary Statement of Information for Sponsors of Works Progress Administration Projects," under Section 12, Item 8, the very significant statement is made that "City, County and State planning agencies *shall* be consulted on all projects which affect plans and programs under the jurisdiction of such agencies. In all such cases the proposed project shall be submitted to the planning agency and its recommendations secured and entered under this item." (The italics are mine.) Item 9 also refers in a sense to proper planning, as follows: "Some projects will fall under the partial or technical jurisdiction of other agencies, as for example, a sewage disposal project which should be reviewed by the State Department of Health. In all appropriate cases projects should be submitted to such agencies and their recommendation secured and entered under this item."

I want to emphasize the importance of having all applications clear through one agency. In the city of Glendale the city engineer is the coordinating agent for all departments, except schools, for the submitting of applications for, and the administration of, federal aid projects. This method of control I believe is absolutely essential to proper administration and planning of public works.

Mr. Fox also points out the importance of determining the future population of an area. There are two very distinct and widely divergent views on this subject of future population in Southern California. One is that owing to the decrease in immigration and the birth rate, the population curve has about reached its peak, will soon flatten out, and may even start down. The other view is that we are on the eve of another great increase in population, that before many years this coastal plain from Santa Barbara to San Diego will be one continuous area of homes and factories, owing to a great degree to the construction of highways.

The circular previously referred to from the Works Progress Administration states that projects should be so planned that continuous work may be available for persons on relief. This shows a little different use of the word "planning" from that I have discussed so far. It is very important that the program be so planned that there will be a continuous and fairly steady number of men employed.

While the need for comprehensive planning seems obvious, it is up to us as the leaders in the engineering profession to see that the best planning possible is actually carried into effect in our various communities. At the present time I have in my organization one man who acts as a coordinator on all government projects, and he has assistance as needed. This simplifies matters for our city and also assists those on the government side of the program in that they have a man who is familiar with what has been carried on through previous programs. I also have an assistant city engineer who supervises the foremen assigned by the city and sees that each job is supplied with the necessary men and materials, thereby eliminating as much criticism as possible of those who are supervising the projects for the government.

J. C. ALBERS, Assoc. M. Am. Soc. C.E.
City Engineer and Street Superintendent

Glendale, Calif.
September 6, 1935

Accidents on Colorado River Aqueduct

To the Editor: Supplementing Mr. Burkholder's article, "Colorado River Aqueduct Tunnels," in the September issue, I submit the three graphs in Fig. 1, covering the entire year 1934 and the first five months of 1935.

Figure 1 (*a*) shows the man-hours expended per month. Figure 1 (*b*) indicates the downward tendency in accident frequency and the progress that has been made in that respect. The interruption in this downward trend during the months of June, July, and August 1934 can be attributed to excessive heat. This second graph indicates that the lowest frequency attained to date was during December 1934 and January 1935.

As shown in Fig. 1 (*c*), a peak in monthly average footage per shift was reached in December 1934, with a good record in this respect in January 1935. It is interesting to note that during December 1934, 4.14 miles of tunnel was driven by District and contractors' forces combined, while in January 1935 the same forces completed the driving of 4 miles. Graph (*c*) of Fig. 1 is comparable to graphs (*a*) and (*b*), in which approximately 94 per cent of the man-hours and accidents during the months of December 1934 and January 1935 were on excavation work.

Tunneling operations on the aqueduct have been beset by many obstacles, including a large proportion of soft, blocky, or otherwise unstable ground; heavy inflows of water at certain points; a considerable number of employees with little or no previous underground experience, as a result of the requirements that workmen, with certain exceptions, must be residents of the Metropolitan Water District; labor turnover; and desert conditions, especially excessive heat during the summer months.

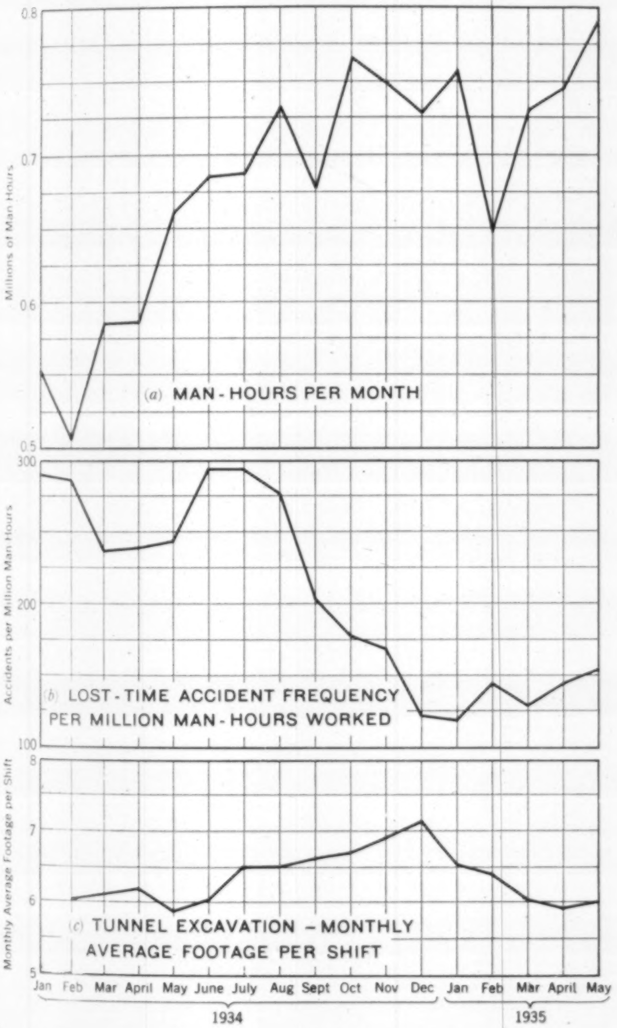


Fig. 1. Relation Between Man-Hours, Accidents, and Progress of Excavation Work, Metropolitan Water District of Southern California

Showing How Accidents Decreased During Progress of the Work

Table I. Tabulation of Compensable Injuries Sustained by All Metropolitan Water District Employees During 1933 and 1934, According to Causation, Frequency, and Severity

Including Only Direct Employees of the Metropolitan Water District—No Contractors' Employees

Causation	No. of Injuries Reported 1933–34*	Percentage of No. of Injuries Reported	Severity Expressed in Percentage of Cost
Explosives	20	0.5	11.1
Falling rock	839	19.4	35.2
Falling objects, other than rock	200	4.6	2.1
Falls of persons from elevations	110	2.5	7.8
Hand-handling of materials and equipment	762	17.6	4.5
Hand tools	357	8.2	2.1
Haulage, tunnel	325	7.5	16.9
Machinery and power equipment, including air drills	171	3.9	8.4
Miscellaneous	849	19.6	8.4
Moving, rolling, swinging, or flying objects	702	16.2	3.5
Totals	4,335	100.0	100.0

* Includes lost-time injuries and some that did not result in loss of time.

In Table I the causes of accidents are given, both by frequency and severity. Attention is called particularly to those caused by falling rock, where the percentage frequency is 19.4, while the severity percentage is 35.2; and to "tunnel haulage," where the frequency is 7.5 per cent, whereas the severity percentage is 16.9 per cent. On the other hand, "hand-handling of materials and equipment" shows a frequency percentage of 17.6 against a severity percentage of 4.5, and "miscellaneous" indicates a frequency percentage of 19.6 as contrasted to a severity percentage of 8.4.

The 1934 record showed a 99.7 per cent reduction in the cost of injuries caused by explosives. When the difference in man-hours is taken into account, a 41 per cent reduction is indicated in the cost of injuries from falling rock. During the two years 1933 and 1934, however, six men were killed by falling rock—three while timbering, one while drilling, one while barring down, and one while working on track. During these two years, falls of rock while timbering accounted for three deaths and for compensation and medical costs of more than 41 per cent of the total from falling rock. Falls of rock while drilling accounted for compensation and medical costs of 15 per cent of the total from falling rock.

The data shown in Fig. 1 were prepared by T. W. Osgood, Assoc. M. Am. Soc. C.E., Safety Engineer of the District. H. M. Wolflin, Senior Engineer of the District in charge of compensation claims, prepared the material for Table I.

J. Carson Agnew, M. Am. Soc. C.E.
Director, Winston Brothers Company

Los Angeles, Calif.
September 9, 1935

Need for Book on Beam Deflections

To the Editor: I should like to express a long-standing wish that some enterprising publisher would bring out a book on beam deflections. That the subject is fascinating to many is attested by the additions continually being made to an already extensive literature. A symposium of what has been written, some of which is in publications not widely known, would be of interest to a number of instructors and engineers. This number might not be great enough to warrant publication with a view to profit, but perhaps some society or benevolent individual might be willing to assume financial responsibility.

One or two of our able professors, in cooperation, would probably be willing to prepare the manuscript if assured of its publication. The proposed volume should give deflection calculations for cases of loading by all methods so that comparison could easily be made. Historical notes should be added. Leonhard Euler (1707–1783), the author of the earliest and best-known method, might well be quoted, and he could be followed by a host of other writers.

Robins Fleming
American Bridge Company

New York, N.Y.
August 27, 1935

Fall Meeting in Birmingham, Ala.

Thomas Jefferson Hotel to Be Headquarters for Gathering October 16–19, 1935

Opening Session and General Meeting

WEDNESDAY—October 16, 1935—Morning

9:00 **Registration**

Members may register beginning 2:00 p.m. Tuesday, October 15.

10:00 **Meeting Called to Order by**

W. H. CARUTHERS, *Assoc. M. Am. Soc. C.E.; President, Alabama Section, Am. Soc. C.E.*, Birmingham, Ala.

Address of Welcome

HONORABLE JAMES J. JONES, JR., *President, City Commission*, Birmingham, Ala.

Responses

ARTHUR S. TUTTLE, *President, American Society of Civil Engineers; Consulting Engineer; New York State Engineer and Acting State Director, Federal Emergency Adminstration of Public Works*, New York, N.Y.

10:45 **Address on "Part Played by the Engineer in the Development of Alabama and the South"**

DR. LEE BIDGOOD, *Dean, School of Commerce and Business Administration, University of Alabama*, Tuscaloosa, Ala.

12:00 **Luncheon**

No formal luncheon has been planned. Members will be free to meet old friends and make new acquaintances during the luncheon period.

WEDNESDAY—October 16, 1935—Afternoon

GENERAL MEETING
D. H. Sawyer, Vice-President, Am. Soc. C.E.
Presiding

2:30 **Symposium on the Past and Future Development of the Southeast**

(1) Industrial

E. A. YATES, *M. Am. Soc. C.E., Vice-President, Commonwealth and Southern Corporation*, New York, N.Y.

POWER DRILLING IN THE MUSCODA ORE MINES
Tennessee Coal, Iron and Railroad Company

(2) Transportation

FITZGERALD HALL, *President, The Nashville, Chattanooga and St. Louis Railway*, Nashville, Tenn.

(3) Rivers and Harbors

E. M. MARKHAM, *M. Am. Soc. C.E., Major-General, Chief of Engineers, U.S.A.*, Washington, D.C.

4:00 **Summary**

DR. GUSTAVUS W. DYER, *Professor of Economics, Vanderbilt University*, Nashville, Tenn.

4:20 **Questions and Answers**

On account of the wide scope of the subjects covered in the symposium, the speakers of the afternoon will remain on the platform to answer questions by members of the audience.

JORDAN DAM, ALABAMA POWER COMPANY

WEDNESDAY—October 16, 1935—Evening

Dinner, Entertainment and Dance in the Ball-Room of the Thomas Jefferson Hotel

7:00 **Assembly**

7:30 **Dinner**

8:30 **Addresses**

TOASTMASTER

HUGH MORROW, *Esq., President, Sloss-Sheffield Steel and Iron Company*, Birmingham, Ala.

SPEAKERS

The Honorable BIBB GRAVES, *Governor of the State of Alabama.*

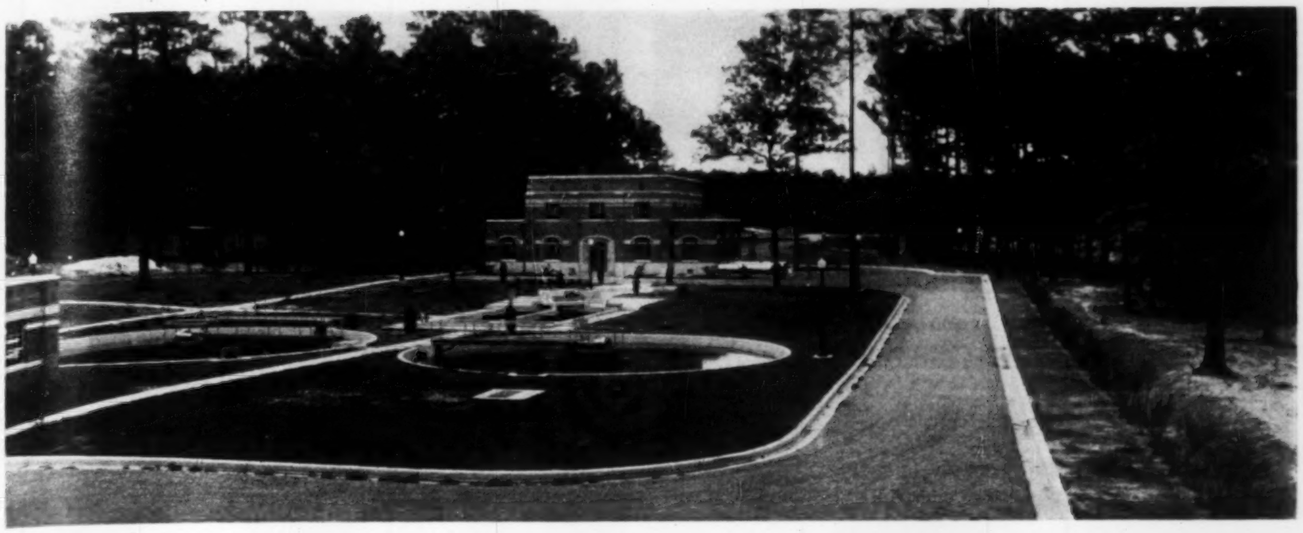
ARTHUR E. MORGAN, *M. Am. Soc. C.E., Chairman of the Board, Tennessee Valley Authority*, Washington, D.C.

9:30 **Intermission**

10:00 **Dancing Until 1:00 p.m.**

Tickets are $3.50 each. Tickets for Juniors and Students in attendance, for the dance only, will be $1 each ($2 per couple).

Consult Your Ticket Agent Early About Reduced Rail Rates and Selling Dates



Shades Valley Sewage Disposal Plant, Birmingham

One Day Devoted to Sessions of Technical Divisions

THURSDAY—October 17, 1935

SANITARY ENGINEERING DIVISION

Morning

9:30 **Experiments on Sewage Treatment at Atlanta**

M. T. Singleton, *M. Am. Soc. C.E., Consulting Engineer,* Atlanta, Ga., and G. R. Frith, *Esq., Chemist in Charge of the Experimental Plant,* Atlanta, Ga.

Discussion Opened by

William A. Hansell, *M. Am. Soc. C.E., Assistant Chief of Construction and Engineer of Sewers,* Atlanta, Ga.

10:30 **Malaria Control Work in Alabama and the Tennessee Valley**

W. G. Stromquist, *M. Am. Soc. C.E., Sanitary Engineer, Tennessee Valley Authority,* Knoxville, Tenn.

Discussion Opened by

G. H. Hazlehurst, *Esq., Chief Engineer and Director, Division of Sanitation, State Department of Public Health,* Montgomery, Ala.

11:00 **Chemical Precipitation of Sewage**

H. H. Hendon, *Assoc. M. Am. Soc. C.E., Sanitary Engineer, Jefferson County,* Birmingham, Ala.

11:30 **Discussion Opened by**

A. Clinton Decker, *M. Am. Soc. C.E., Sanitary Engineer, Tennessee Coal, Iron and Railroad Company,* Birmingham, Ala.

SURVEYING AND MAPPING DIVISION

Morning and Afternoon

9:30 **Surveying and Mapping in the Tennessee Valley**

N. H. Sayford, *M. Am. Soc. C.E., Director, Engineering Service, Tennessee Valley Authority,* Knoxville, Tenn.

Discussion Opened by

George D. Whitmore, *Assoc. M. Am. Soc. C.E., Chief, Survey Section, Engineering Service Division, Tennessee Valley Authority,* Knoxville, Tenn.

Thomas P. Pendleton, *M. Am. Soc. C.E., Assistant Section Chief, Chattanooga Office, U. S. Geological Survey,* Chattanooga, Tenn.

10:30 **Permanent Value for Highway Surveys Through Geodetic Control**

J. C. Carpenter, *M. Am. Soc. C.E., Senior Highway Engineer, U. S. Bureau of Public Roads,* Fort Worth, Tex.

Discussion Opened by

Mason Johnson, *Assoc. M. Am. Soc. C.E., Resident Engineer, State Highway Department,* Corpus Christi, Tex.

Wm. W. Zass, *M. Am. Soc. C.E., Chief Engineer, State Highway Commission,* Little Rock, Ark.

Thomas W. Bailey, *M. Am. Soc. C.E., Division Engineer, State Highway Commission,* Corpus Christi, Tex.

Air View of Central Business District, Birmingham

2:00 **Local Control Surveys of the U. S. Coast and Geodetic Survey in Alabama**

J. A. C. Callan, *M. Am. Soc. C.E., Head Professor, Civil Engineering, Alabama Polytechnic Institute,* Auburn, Ala.

Discussion Opened by

Philip Kissam, *Assoc. M. Am. Soc. C.E., Assistant Professor, Civil Engineering, Princeton University,* Princeton, N.J.

3:00 **Locating the Southern Natural Gas Pipe Line by Aerial Maps**

N. R. McKay, *Esq., Southern Natural Gas Corporation,* Monroe, La.

3:30 **Discussion**

JEFFERSON COUNTY COURT HOUSE
Exemplifies the Finest of Modern Municipal Architecture

RUINS OF OLD TANNEHILL STEEL FURNACES, NEAR BIRMINGHAM
Example of Early American Steel Manufacture

CONSTRUCTION AND HIGHWAY DIVISIONS

Morning and Afternoon

9:30 **Low-Cost Highway Construction in Tennessee**

FRANK W. WEBSTER, *M. Am. Soc. C.E., Principal Highway Engineer, Tennessee Valley Authority,* Knoxville, Tenn.

10:30 **Low-Cost Road Construction and Stabilization of Bases**

C. A. HOGENTOGLER, *Assoc. M. Am. Soc. C.E., Highway Engineer, Division of Tests and Research, U. S. Bureau of Public Roads,* Washington, D.C.

11:00 **Discussion**

2:00 **Construction Methods on the Lake Okeechobee Drainage Project, Florida**

EARL I. BROWN, *M. Am. Soc. C.E., Colonel, Corps of Engineers, U.S.A.,* Richmond, Va.

2:30 **Construction Methods at Norris Dam**

ROSS WHITE, *M. Am. Soc. C.E., Construction Superintendent, Tennessee Valley Authority,* Norris, Tenn.

3:00 **Discussion, Followed by**

Motion Picture on Construction Work at Norris Dam.

STRUCTURAL DIVISION

Afternoon

2:00 **Design Features of the Mississippi River Bridges**

HARRY J. ENGEL, *Jun. Am. Soc. C.E., Assistant Engineer, Modjeski, Masters and Case, Inc.,* Philadelphia, Pa.

3:00 **Unique Features of Design in Connection with the Construction of Fifteen Toll Bridges in Alabama**

H. H. HOUK, *M. Am. Soc. C.E., Chief Engineer, Alabama State Highway Department,* Montgomery, Ala.

4:00 **Bessemer High School Stadium**

W. N. WOODBURY, *Esq., Engineer, Virginia Bridge and Iron Company,* Birmingham, Ala.

STUDENT CHAPTER CONFERENCE

THURSDAY—October 17, 1935—Afternoon

At 2 p.m. on Thursday afternoon, October 17, there will be held a conference of representatives from the Student Chapters. In addition to official representatives, as many student members as practicable, together with faculty advisers and contact members, are expected. The conference will be open to discussion of any subjects of interest to the Chapters, and after the meeting an abstract of the proceedings will be sent to every Chapter in the country.

TYPICAL SCENE IN ALABAMA'S HUGE COTTON INDUSTRY
Hauling Cotton to the Gin

Entertainment for the Ladies

WEDNESDAY—October 16, 1935—Afternoon

2:30 **Automobile Drive Through the Residential Section of Birmingham Followed by Tea at the Mountain Brook Country Club**

Leaving the Thomas Jefferson Hotel at 2:30 p.m., the ladies will be taken for a sightseeing tour of Birmingham's residential sections.

Birmingham is known for its beautiful residential district, located in the picturesque hills adjacent to the city. After driving through the parks and parkways a stop will be made at Vestavia, the home of George B. Ward, which is a replica of the ancient temple of Vesta near Rome, Italy.

Leaving Vestavia the party will go to the Mountain Brook Country Club, where tea will be served. This club has been erected recently and is numbered among the most beautiful in the country. The party will leave the club in time to arrive at the Thomas Jefferson Hotel about 5:00 p.m.

Tickets for the drive may be obtained at the registration desk.

THURSDAY—October 17, 1935—Afternoon

12:30 **Luncheon and Bridge at the Birmingham Country Club**

Leaving the Thomas Jefferson Hotel at 12:30, the ladies will go by automobile to the Birmingham Country Club, a drive of about three miles. Following luncheon the ladies will be entertained at bridge. For those who may not wish to play cards there will be a wealth of other opportunities for enjoying the unusual facilities of this up-to-date country club.

The party will leave the club in time to arrive at the Thomas Jefferson Hotel about 5:00 p.m.

Tickets are $1 each.

THURSDAY—October 17, 1935
Evening

7:00 **"An Evening in the Deep South"**

The ladies and their escorts will assemble for supper—"suh"—amid the colonial surroundings of the Mountain Brook Country Club.

There will be a buffet service featuring a menu reminiscent of plantation days.

Appropriate entertainment!

You wear the "glad rags" and let the "pickaninnies" dress the part.

Transportation will be furnished, leaving the Thomas Jefferson Hotel at seven o'clock.

Tickets $2.50 each.

The Ladies Committee has long been preparing for the various functions designed to provide an interesting series of trips and luncheons for visiting ladies.

The plans have been perfected to assure that both local and out-of-town ladies will enjoy these functions to the maximum. At this season of the year the climate and foliage are ideal for complete enjoyment of drives and out-of-door social entertainment.

All-Day Excursion on Friday

FRIDAY—October 18, 1935—Morning and Afternoon

8:30 **All-Day Excursion on Friday to Tennessee Coal, Iron and Railroad Company's Works**

Through the courtesy of the Tennessee Coal, Iron and Railroad Company, members, ladies, and guests of the Society will have the unusual opportunity of seeing the whole operation of the manufacture of iron and steel from the raw materials to the finished products. The iron ore mines on Red Mountain, where an available supply of a billion five hundred million tons is located, the limestone quarries in an overlying deposit, and the coal mines in an adjacent valley will be visited. The excursion will continue through the by-product coke works, blast furnaces, open-hearth furnaces, and rolling mills, extending over approximately 1,500 acres.

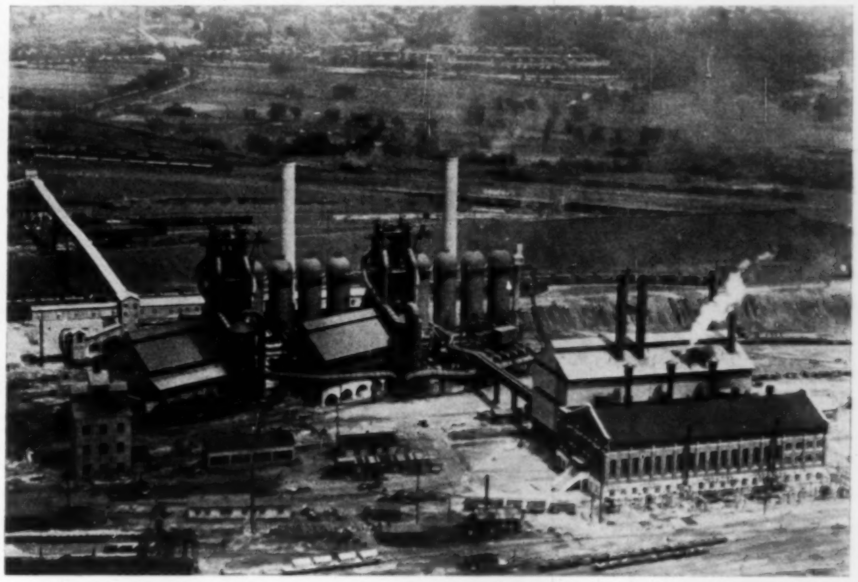
Among the products manufactured at the Fairfield Steel Works are plates, shapes, and bars, cotton ties and hoops, reinforcing rods, tie plates, spikes and bolts, billets, blooms, slabs and sheet bars, and the various products of the enormous sheet and jobbing mills. There are also produced at Fairfield wire products ranging from carpet tacks to barbed wire and the various types of fencing.

An unique feature of these properties is the transportation system connecting the mines, quarries, and manufacturing plants. The "High Line," extending over five miles and crossing six railways and numerous highways without a grade crossing, is particularly worthy of note.

Visitors will be specially conducted through these works.

Luncheon will be served at the Fairfield Steel Works.

A special train will leave the Louisville and Nashville Railway Station, 20th Street and Morris Avenue, at 8:30 a.m. and will arrive in Birmingham on the return trip about 5:00 p.m. Tickets for the trip must be secured at the time of registration.



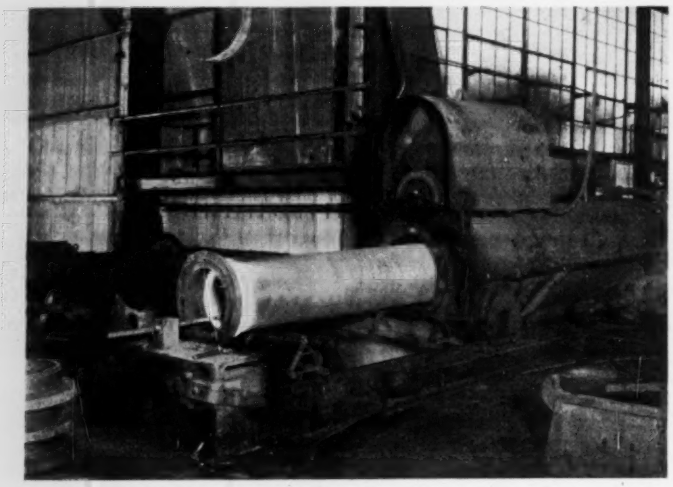
Blast Furnaces and Power House of Fairfield Steel Works
Tennessee Coal, Iron and Railroad Company

SATURDAY—October 19, 1935—Morning

10:00 **Inspection Trips**

Arrangements have been made for visits to the following points of engineering interest:

1. Blast furnaces
2. Cement plants
3. Steel fabricating plants
4. Cast-iron pipe manufacturing plants
5. Shades Valley sewage treatment plant
6. Hydro-electric plants of the Alabama Power Company, at Jordan Dam and Mitchell Dam



Heavy Pipe Cast by Centrifugal Method, Birmingham

Announcements, Railroad Rates, Hotel Accommodations

In order to be certain of accommodations, members are urged to make definite arrangements for rooms at least a week in advance of the Fall Meeting, paying for the rooms in advance for at least a part of the period during which they expect to be in Birmingham.

Hotel Rates

With Private Bath

Hotels	Single Rooms	Double Rooms	Twin Bedrooms
Thomas Jefferson (1631—2nd Ave. N., Tel. 7-7141)	$2.50–4.00	$3.50–5.00	$4.00–6.00
	(Suites available from $8.00 to $15.00 a day)		
The Tutwiler (2005–5th Ave. N., Tel. 7-8161)	$3.50–6.00	$4.50–7.00	$6.00–10.00
Hotel Molton (507 N. 20th St., Tel. 3-7243)	$2.00–2.50	$3.00–3.50	$4.00
Redmont Hotel (2101–5th Ave. N., Tel. 3-0171)	$2.00–3.50	$3.50–5.00	....
Hotel Bankhead (2300–5th Ave. N., Tel. 3-3233)	$2.00–4.00	$3.00–4.00	$4.00–6.00

Note: The Thomas Jefferson Hotel, at which the meetings and downtown social functions will be held, will care for reservations to the extent of its capacity. Other hotels are listed in the order of their proximity to the headquarters hotel.

Reservations are to be made directly with the hotel as early as possible in order to prevent delay and inconvenience in obtaining accommodations on arrival.

All who attend the Fall Meeting are requested to register immediately upon arrival at meeting headquarters, the Thomas Jefferson Hotel. Special badges and tickets will be obtained at the time of registration.

Mountain Brook Country Club

Reduced Railroad Rates

In order to accommodate those members who reside in territory not served by reduced round-trip rates in effect, reduced rates on the certificate plan (fare and one-third of the current one-way first class fare), may be obtained.

Reduced rates for the round trip are in effect in eastern territory to points in the southeast. For some of the western states, summer excursion fares will apply, and in some cases may be on a lower basis than the certificate plan.

Members should consult their local ticket agents early as to which fare plan is the lower.

Do not fail to obtain a certificate from your ticket agent if the certificate plan is utilized.

Local Section Conference

On Tuesday afternoon and evening, October 15, 1935, there will be a Conference of Delegates from the 14 Local Sections in the Southern Meeting Region with the Society's Committee on Local Sections and the Southern Region Meetings Committee.

A comprehensive agenda has been prepared for the discussion of activities of mutual interest to the Local Sections.

All interested members are invited to attend and participate in the conference.

Information

An information and registration desk will be provided in the lobby of the headquarters hotel to assist visiting members in obtaining hotel reservations and securing any desired information about the city. At the registration desk, a card file of those in attendance will be maintained, with information as to members' hotel addresses in Birmingham. Members are requested to keep headquarters informed of their Birmingham addresses so as to expedite the delivery of telegrams, telephone message and mail.

Entertainment

Attention is directed to the program for the entertainment of the ladies. In addition, the ladies are expected to participate in all the other features of the meeting which may interest them.

Members wishing to play golf may make application at the registration desk, and arrangements will be made to play at the Birmingham country club or Mountain Brook country club.

Invitation to Student Members

Attention of student members is called to the Student Conference on Thursday afternoon. Members of Student Chapters are also invited to attend and participate in all the events of the Fall Meeting.

All Meetings and Functions Are on Central Standard Time

THOMAS JEFFERSON HOTEL
Meeting Headquarters in Birmingham

Order All Tickets in Advance

Members who order tickets in advance will not only be saved annoyance and delay by having tickets and badges awaiting them on arrival at headquarters, but they will assist the committee greatly by giving advance information to guide it in concluding arrangements.

See page 22 in back of this issue for registration and ticket order forms.

Local Committee on Arrangements

WILLIAM H. CARUTHERS, *Chairman*
GEORGE JACOB DAVIS, JR., *Vice-Chairman*

H. A. DAVIES
F. E. HALE
H. H. HENDON
H. H. HOUK
R. D. JORDAN
E. E. MICHAELS
A. R. PEYTON
A. C. POLK
R. A. SMALLMAN
O. G. THURLOW

Ladies Committee

MRS. MORRIS W. BUSH, *Chairman*
MRS. ARMOUR C. POLK, *Vice-Chairman*
MRS. OSCAR G. THURLOW, *Vice-Chairman*
A. CLINTON DECKER, VICTOR H. HANSON, ERSKINE RAMSAY, *Coordinators*

MRS. J. M. BARRY
MRS. H. D. BURNUM
MRS. WALLACE L. CALDWELL
MRS. J. A. C. CALLAN
MRS. W. H. CARUTHERS
MRS. THOMAS CHALMERS
MRS. J. E. CHAPPELL
MRS. ASHTON COLLINS
MRS. G. W. CONNORS
MRS. J. B. CONVERSE
MRS. J. H. CONZELMAN
MRS. J. W. COTLIN
MRS. G. G. CRAWFORD
MRS. FRANK CROCKARD
MRS. Herbert A. DAVIES
MRS. GEO. J. DAVIS, JR.
MRS. F. J. EVANS
MRS. H. L. FISHER
MRS. J. S. GILLESPY
MRS. J. H. GLANDER, JR.
MRS. C. B. GLENN
MRS. F. E. HALE
MRS. HORACE HAMMOND
MRS. JOHN HAWN
MRS. WALTER E. HENLEY
MRS. H. H. HENDON
MRS. H. H. HOUK
MRS. R. I. INGALLS
MRS. C. E. IRELAND
MRS. ROBERT JEMISON, JR.
MRS. J. WALLACE JOHNSTON
MRS. R. D. JORDAN
MRS. H. L. LACLAIR
MRS. KARL LANDGREBE
MRS. T. Wallace MARTIN
MRS. A. E. MAUMENEE
MRS. J. H. MAYER
MRS. E. E. MICHAELS
MRS. JAS. E. MILLS
MRS. KEY MILNER
MRS. J. L. PERRY
MRS. A. R. PEYTON
MRS. ANDREW C. RAMSAY
MRS. HERBERT C. RYDING
MRS. F. W. SHEPPARD
MRS. P. G. SHOOK
MRS. WARNER SHOOK
MRS. R. A. SMALLMAN
MRS. ROSS SMITH
MRS. THEODORE SWANN
MRS. H. C. WELLS
MRS. OSCAR WELLS
MRS. FELTON WIMBERLY

The program as a whole has been prepared under the direction of the Southern Regional Meeting Committee, DONALD H. SAWYER, *Vice-President, Am. Soc. C.E., Chairman;* and FREDERICK H. MCDONALD, E. N. NOYES, HERMAN STABLER, W. W. HORNER, *Directors Am. Soc. C.E.*

Please call on the Committee on Local Arrangements or on the Secretary's office for any service desired.

ADMINISTRATION BUILDING, BIRMINGHAM MUNICIPAL AIRPORT

SOCIETY AFFAIRS

Official and Semi-Official

Reports on Fees and Salaries Are Questioned

Objections of Sacramento and San Francisco Sections Answered by Committee Chairman

At its meeting on April 3, 1935, the Board of Direction authorized the publication of a report from the Committee on Fees, which it had just approved, and the republication under the same cover of the report from the Committee on Salaries similarly approved on July 10, 1934. Criticism of this joint publication, and more especially of the republication of the Report on Salaries, was voiced by the Sacramento and the San Francisco Sections. The Board therefore referred the matter to the Committee on Salaries for report to the Executive Committee.

Subsequently, by action of the boards of directors of the Sacramento and San Francisco Sections, request was made that a letter prepared by Vice-President H. D. Dewell be published in CIVIL ENGINEERING. *Under the rules governing that publication, printed criticism of actions approved by the Board is to be accompanied by a statement from the chairman of the committee having responsibility in the matter. Accordingly, Vice-President Dewell's letter and the reply of E. P. Goodrich, chairman of the Committee on Salaries, are here presented.*

VICE-PRESIDENT DEWELL'S LETTER

55 New Montgomery Street
San Francisco, Calif.
July 24, 1935

To the Committee on Salaries
American Society of Civil Engineers
c/o Mr. Geo. T. Seabury, Secretary
33 West 39th Street
New York City, N.Y.

Gentlemen:

At the meeting of the Board of Direction in connection with the 1935 Summer Meeting at Los Angeles, there were presented criticisms of your report on salaries of engineers and its recent republication in what might be termed manual form by the Society. These criticisms came from both the Sacramento and San Francisco Sections of the Society. The specific thoughts of the Sacramento Section on the subject were set forth in a letter to me, as Vice-President, written by Mr. Frank D. Talbot, Secretary of the Section, under date of June 26th, 1935. Accompanying Mr. Talbot's letter were illustrative graphs of comparative fees and salaries of 1930 and 1935 as such fees and salaries have been studied and published by your committee and the Society. Mr. Talbot's letter was read to the Board of Direction by Director Etcheverry, after which he ably presented a brief résumé of the dissatisfaction which the Sacramento Section feels with the salary schedule. Director Etcheverry also presented the critical comments of the San Francisco Section, as expressed by a special meeting of its Board of Directors, held on June 28th, 1935.

A short discussion on the subject then took place and the matter was postponed until the following morning when Mr. Thomas E. Stanton, Past President of the Sacramento Section and a member of the Aims and Activities Committee was present and more fully explained the objection of his Section to the salary schedule and its publication by the Society.

At this same meeting of the Board of Direction, a letter on the same subject was read from Mr. H. J. Brunnier, Vice President of the San Francisco Section and a member of the Board of Consulting Engineers on the San Francisco–Oakland Bay Bridge. He expressed in his letter the disappointment which is generally felt, I think, by members of the San Francisco Section with the publication of this report on salaries, in that the Society is apparently recommending, or at least approving, a schedule of salaries which culminates in a remuneration of $6,000.00 a year as the ultimate to which a young engineer can look forward.

I assume that the detailed record of the discussion of this subject by the Board of Direction will be transmitted to you for your consideration.

I am writing to you to urge that you give these criticisms your most serious consideration. I am, of course, ignorant of the reception with which the publication of the report of your committee has been received throughout the country, but I feel certain that among engineers of California its publication has been unfortunate and has caused much adverse criticism. I would not presume to deny that the report has, in a number of cases, been the cause of preventing a further reduction of the salaries of some engineers, but I am very much inclined to believe that, generally speaking, it has done more harm than good.

It seems to me that the Sacramento Section has raised a particularly pertinent point; namely, that the recommended fees for consulting engineers have been increased over those of 1930, and that correspondingly the proper salaries of their engineering employees have been reduced from those of the same year. The objections to the report as published, which I have heard, may be summarized as follows:

1. The re-publication of the salary schedule in the same booklet with the schedule of recommended fees, and the form, wording and prominence of the title of the booklet, give the impression that the two schedules are the work of the same committee and that the salary schedule, as well as the schedule of fees, is a recommendation of the Society.
2. The re-publication of the salary schedule in the same booklet form which has been used for manuals of practice gives an impression of permanency.
3. The maximum fees recommended in the schedule of professional fees is in excess of those recommended previously, while the curve of salaries lies below that of previous years.

> The fact that there is no definite statement that the salaries are not recommended salaries, but that they represent a compilation of actual data, is not sufficiently emphasized and is not realized by the ordinary reader.

4. Almost any laymen, upon picking up the booklet and casually examining it, would gain the impression that $6,000.00 per year represents a maximum salary that is proper for an engineer.
5. The curve of salaries, as published, does not represent a true average of salaries paid engineers throughout the country.
6. Even though it may be shown that the curve represents the average of salaries paid engineers in certain classes of work and in depression times, there is nothing gained in advertising the fact that engineers, under press of temporary economic conditions, are accepting remuneration less than is justified by the importance of their work.

It seems to me that our Society should make every effort to increase the amount of remuneration of engineers, both those on salary and those in private practice. Conversely, we should do nothing that could possibly give the impression that some of the low salaries or fees now being paid are proper. And certainly our Society should do nothing, particularly in this time of general unrest, to raise animosity in the minds of its members, or give any food for the thought that we are not interested in their welfare. I believe that,

1. Further distribution of this pamphlet or manual should be immediately stopped.

2. A revised manual containing only the recommended fees for engineers in private practice should be published.

3. Your committee should prepare a curve or schedule of salaries which you consider proper in normal times for engineering services for the class of work and qualifications established in your present report.

For convenience and easy reference, a separate curve should be published for each different condition of locality and population recognized by the report.

4. If it is thought necessary to furnish information for modifications of the basic salary schedules for special conditions, these modifications should be given only in percentage terms and in special communications to serve the particular and temporary need.

5. This recommended schedule should be given the widest publicity possible by the Society.

6. The Society should make every proper and legitimate effort to see that actual salaries paid be brought to this schedule as rapidly as economic conditions permit.

I believe that work along this line could be effectively and properly done through the Local Sections, supported energetically by the administrative offices of the Society and its Board of Direction. I believe that the recently appointed new officer, the Field Secretary, could be of substantial help in securing a common interest and united action by the various Local Sections.

Despite the fact that this letter criticizes your report, it is not a criticism of the motives activating the preparation of the report, for I am fully cognizant of the earnest desire of the Society and your committee to secure proper remuneration for engineers. Further, I am not unappreciative of the immense amount of valuable work that you have done in collecting data on the subject of salaries. I feel that I, myself, as a member of the Board of Direction, am just as much at fault as anyone in that I acceded to the adoption, publication and re-publication of the report. I sincerely feel that a grievous mistake has been made and I wish to do everything that I can to see that no further harm is done.

Yours very sincerely,
Henry D. Dewell
Vice-President, Zone IV
Am. Soc. C.E.

In This Issue . . .

Reports on Fees and Salaries Are Questioned . . . . *p. 650*
Improvements Proposed in U. S. Weather Bureau . . . . *p. 654*
How the Society Gets a New Deal . . . . *p. 655*
New Society Committee on Aims and Activities . . . . *p. 652*
Engineering Schools to Be Accredited by E.C.P.D. . . . . *p. 652*
Volume 100 of "Transactions" Is Published . . . . *p. 652*
Students Receive Local Section Awards . . . . *p. 657*

Reply for the Committee on Salaries

Vice-President Dewell's letter addressed to the Committee on Salaries commenting upon a Report of the Committee on Salaries adopted by the Board of Direction under date of July 10, 1934, suggests that the "Society should make every effort to increase the amount of remuneration of engineers, both those on salary and those in private practice." In this the writer heartily concurs. It has always been the objective of the Society's Committee on Salaries.

The writer regrets, however, that a public discussion of the criticisms raised by the Sacramento and the San Francisco Sections should appear to be necessary before returns have been received from inquiries, made by the Committee, of certain Section officials, which would throw light upon the local, or perhaps personal elements which induced the criticism.

Mr. Dewell's letter may be divided into three parts: First, a narration of the circumstances occurring at the Board of Direction meeting held on July 3, 1935; second, six comments on the Committee's Report on Salaries and its relation to the report of another committee with respect to fees; third, the suggestion that there be developed a schedule of salaries which may be considered proper in normal times.

With respect to the first phase of his letter, there is no need for comment because it is simply a narration of Mr. Dewell's observations with respect to the Board procedure.

In the second phase of his letter, three of his suggestions have to do with the subject of printing, which is a matter to be handled by the Executive Committee of the Society; and three consist of comments on the Report of the Committee on Salaries prepared in 1934. As chairman of the Committee on Salaries, I might take exception to all three of these comments in some particular or another, e. g., the statistical value of the "median" over the "average" suggested by Mr. Dewell. It is my firm belief, however, that the engineers of this country, by and large, would be fortunate indeed if they could obtain today the salaries which are indicated in the Report as those which were being paid in 1934.

I will speak later of the third phase of Mr. Dewell's letter as it deals with a matter which I have been studying for some time and in which I am very much interested.

The Committee on Salaries has devoted itself to a determination of facts and has collected an enormous amount of data through the medium of questionnaires and individual inquiries. At the time the Report on Salaries was presented in March 1934, it was based on the salaries of approximately 16,000 civil engineers in the 48 state highway departments. At that time there was in process a very general movement by the several governmental agencies to decrease the salaries in their engineering staffs. The motive of the Report was to afford a basis which would assist those staffs to demonstrate their situation with respect to those in adjacent states, or to that in the country at large. For its value as a precedent, the states were grouped arbitrarily on the basis which had been adopted by the Bureau of Public Roads of the Department of Agriculture for the determination of the wages which it would support in its federal-aid projects.

The Report was prepared at short notice and certain expressions in it being observed to be somewhat in the nature of recommendations, the Report was revised, in the form approved by the Board of Direction on July 10, 1934, to remove those expressions, leaving the Report simply a statistical analysis.

At the time of its revision, additional data had been collected with respect to the salaries of approximately 44,000 engineers in all lines of activity and from a study of these, a regrouping of the states was in contemplation, wherein the local departures from the regional figures would have been less than in the original report. However, the Committee received a suggestion from the President of the Society that at that time it was inadvisable to regroup the states, as it might indicate, in the eyes of some, a degree of uncertainty with respect to the whole report, and it was then deemed wiser to make no change.

More than a year has elapsed since that revision, and perhaps it would now be permissible to again revise the Report in this way. It is a relatively easy matter to accomplish, involving only a rearrangement of the statistical data, and if it is desired, the Committee is quite ready to make such a revision.

With respect now to the third phase of Mr. Dewell's letter, wherein is proposed a schedule of salaries which may be considered proper in normal times—this is not a matter easy of accomplishment, nor practicable in a short period. In the determination of any such authoritative universal schedule of engineers' salaries as proposed, it will be found that there should enter into the problem such matters as the cost of living; the cost of education; local competition both without and within the profession; the significance which should be accorded the age and experience of the engineer and his local, social or political influence, if any; the responsibility placed upon him; the size and complexity of the engineering enterprise; the wealth of the paymaster, be it a city, county, or state; the social benefit of the enterprise measured from an economic standpoint; and several other factors. It is easy to set up an arbitrary schedule of rates for any local activity based on local conditions, but to formulate a logical ideal salary scale for any district, with the proper supporting data, and to justify it in the eyes of the profession, of society, and of the responsible administrative officers is a much more difficult undertaking.

In a later issue I would like to outline the elements which should enter into the formulation of such a system of standard salaries and the progressive studies which would be involved. For the present, however, I believe a strictly statistical analysis of the facts to be desirable and effective.

E. P. GOODRICH
Chairman, Committee on Salaries

Lantern Lectures Now Available

AS THIS MONTH'S ISSUE of CIVIL ENGINEERING is put in the mails, there will also go out, to the Student Chapters of the Society, a letter announcing in detail the series of lantern lectures available without charge for their use during the coming school year. The first of these lectures were prepared in the fall of 1929. Additional titles have been issued from time to time, until the Chapters now have the choice of 14 different subjects, any or all of which they may reserve in advance for showing at their meetings. Groups other than Student Chapters may borrow any lecture if it has not previously been reserved.

As sent out from the Headquarters office, the slides for each project are accompanied by a mimeographed description and references for additional study. Since the length of the lectures varies with the subject, the list that follows shows the number of slides in each case, which may be useful in making a choice of titles.

TITLE OF LECTURE	NO. OF SLIDES
Aerial Photographic Mapping (new this year)	59
Carquinez Strait Bridge	58
Cascade Tunnel	45
Catskill Water Supply	60
Conowingo Hydro-Electric Development	46
Coolidge Dam	57
Florianapolis Bridge	36
George Washington Bridge (new this year)	74
Hetch Hetchy Water Supply and Power Plant	65
Holland Tunnel	58
Miami Flood Control	53
Recent Power Developments at Niagara Falls	34
Westchester County Park System	38
Wilson Dam at Muscle Shoals	47

Volume 100 of "Transactions" Published

DURING the current month many members—all those who have ordered paper-bound volumes—will receive their copies of TRANSACTIONS. Following the precedent set for the past few years, these paper volumes will be mailed under the same cover as the regular October PROCEEDINGS; that is, they will go in the mails on or about October 15.

Savings in postal charges under this plan are considerable and outweigh the single objection of the necessary modification of covers to meet postal regulations. These paper volumes are required to bear a definite relation to PROCEEDINGS inasmuch as they are issued in that category and at correspondingly reduced charges as "second class matter." Accordingly the paper volumes of TRANSACTIONS have the official designation of "Proceedings, Part 2" and the identifying title of "Transactions Number 1935."

Bound copies of the same volumes in cloth and morocco have to be included in the mailing category of "parcel post" at considerably higher rates. There is some compensation for this in the liberty to use the regulation titles. These volumes therefore retain the time-honored designation of "TRANSACTIONS—Volume 100, 1935." Because of the time required for binding and the greater care needed in handling these "hard-bound" volumes, they cannot be mailed as early as PROCEEDINGS. Members therefore should not expect to receive them until sometime before the middle of November.

New Committee on Aims and Activities

IN OCTOBER 1934, the Board of Direction designated a committee "to study the present activities of the Society with respect to human relations, welfare, and public relations of the Society and of its members, and to make recommendations for changes or amplifications of such activities."

After months of intensive study, this Committee on Aims and Activities made its final report to the Board at the Los Angeles Convention during the current year. After discussing its studies and detailing some of the problems within its purview, the committee made certain specific recommendations, one of the most important of which provided for the continuance of its work in more permanent form. In the words of its report dated July 1, the committee "recommends that it be discharged and that a permanent committee to be known as the Committee on Aims and Activities be created immediately, the objective of which shall be the initiating, energizing and developing of Society policy looking toward the betterment of the professional and economic status of the membership. To this new committee there should be referred all matters developed by the contacts of the Field Secretary with the membership and all problems involving the expansion of the public and human relation activities of the Society. The function of the new committee shall be advisory only and it shall report its conclusions and recommendations to the Board at least semiannually, preferably at the Annual and Summer Meetings."

As a direct result of the approval of this proposal by the Board, a new Committee on Aims and Activities has now been constituted. Its membership has been carefully selected from the standpoint of ability, interest, and qualifications to serve the Society. The following members, listed alphabetically comprise, the new committee:

FRANK A. BARBOUR, consulting engineer of Boston, Mass., for a term ending January 1938. He is a Director of the Society and president of the American Water Works Association for 1935.

GEORGE B. GASCOIGNE, consulting engineer of Cleveland, Ohio, for a term ending January 1936. He has been active in committee work for the Sanitary Engineering Division.

FREDERIC H. MCDONALD, consulting engineer of Atlanta, Ga., for a term ending January 1937. He is a Director of the Society and secretary of the executive committee of the Engineering-Economics and Finance Division.

R. C. MARSHALL, JR., consulting engineer of Washington, D.C., for a term ending January 1937. He is president of the District of Columbia Section of the Society. Formerly he was head of the Construction Division of the U. S. Army, as brigadier general, and later was general manager of The Associated General Contractors of America.

JOHN P. H. PERRY, vice-president of the Turner Construction Company, New York, N.Y., for a term ending January 1936. He is a Director of the Society and has been appointed chairman of the Committee. He has held office as president of the Metropolitan Section and recently as deputy director, Works Relief, New York, N.Y.

T. E. STANTON, JR., materials and research engineer, California Division of Highways, Sacramento, Calif., for a term ending January 1937. He is a former president of the Sacramento Section and chairman of a Special Civil Service Committee of the California State Employees' Association.

ERNEST O. SWEETSER, professor of structural engineering, Washington University, St. Louis, Mo., for a term ending January 1938. He is president of the Engineers' Club of St. Louis.

F. L. THOMPSON, vice-president of the Illinois Central Railroad, Chicago, Ill., for a term ending January 1936. For many years prior to 1925 he was assistant chief engineer and chief engineer of that road.

S. F. VOORHEES, senior partner, Voorhees, Gmelin and Walker, architects, New York, N. Y., for a term ending January 1938. He is president of the American Institute of Architects and formerly was president of the New York Building Congress.

The first meeting of this new committee is being called by Chairman Perry for Birmingham, Ala., in connection with the Fall Meeting of the Society.

Engineering Schools to Be Accredited by E. C. P. D.

PLAN LAUNCHED TO IDENTIFY INSTITUTIONS OFFERING COURSES IN ENGINEERING WORTHY OF RECOGNITION AS SUCH

EIGHTEEN COLLEGES and universities in the New England and Middle Atlantic states offering courses leading to an engineering degree have requested the Engineers' Council for Professional Development (E.C.P.D.) to consider their engineering curricula for accrediting. The group includes many of the large and important engineering schools in these two regions.

As part of its plan to enhance the professional status of engineers, the E.C.P.D. hopes to promote higher standards of education by studying engineering curricula and accrediting those worthy of recognition. The plans for accrediting were dealt with more fully in the March 1935 issue of Civil Engineering, page 186. A list of approved institutions will be published by E.C.P.D. for the assistance of those who wish to make use of it.

The plan, similar to that followed by the medical and legal professions, will be put in effect this fall in the New England and Middle Atlantic states and extended later to other regions of the United States. Both qualitative and quantitative criteria will be used as a basis for accrediting. Qualitative criteria will be evaluated through visits of inspection by regional committees composed of qualified individuals. Quantitative criteria will be evaluated through data obtained from catalogs and by questionnaires.

The questionnaires which the Committee on Engineering Schools spent over a year developing and which were tried out experimentally in a limited number of schools, are now being distributed to the institutions requesting consideration. The material thus obtained will be analyzed and studied as it is returned and will then be presented to the regional committees for their consideration before they visit the institutions.

The prompt acceptance of this plan by so many institutions is an excellent indication of the interest with which this program of the E.C.P.D. is being received. A number of other institutions expressed interest in the matter but found it necessary to defer actual requests until the return of their officers in September.

A Useful Biographical Service

With the yearly printing of Transactions, emphasis is always redirected toward the substantial amount of space devoted to memoirs of deceased members. In the 1935 volume shortly to be distributed, 101 deceased members receive a meed of recognition. To them 215 pages, or about 12 per cent of the entire volume, are devoted. What these biographic accounts in their entirety represent in terms of hours of individual work, and loyalty of surviving friends and relatives, can be understood only by those who have had experience in preparing them.

That the effort is well worth the cost has long been evident to Society officers. Hardly a day passes without some visible token of appreciation, usually from relatives of the deceased members. It is such encouragement that strengthens the conviction of the Publications Committee that the enterprise entirely justifies the expenditure of the time and labor required. The cost to the Society itself, not only in printing, but particularly in the lengthy correspondence frequently entailed, is a very appreciable item.

What a pity it is therefore when in spite of all the affection and interest apparent, the resulting memoir is inadequate or not representative of the career it chronicles. This result, happily infrequent, arises from no fault of the Society. Every effort to secure a suitable account is made. No stone is left unturned, even in case years pass in the effort, as sometimes happens. Not so long ago a memoir of a famous engineer was not finally secured and published until 64 years after his death. Obviously the handicaps multiplied with the passing of years; this man's intimates had themselves been dead for two or more generations. How much better could the memoir have been if only it had been prepared immediately after his death!

Other societies are faced with the same problem. The September 1935 issue of *Mechanical Engineering*, the official publication of the American Society of Mechanical Engineers, states editorially:

"Most of us lead singularly unspectacular lives. We do not, as a rule, have occasion to come frequently to the attention of our fellows to the extent that the press of the nation makes extensive note of our achievements. Even the organizations to which the greater part of our efforts are devoted pay scant attention to a year-by-year record of our services to them. And when death comes suddenly, or after retirement, it too often happens that authoritative and frequently important information is forgotten or utterly lacking. Hence there lies upon each of us the duty of assisting in assembling such data as are important and of supplying those whose responsibility it is to prepare the permanent record with as many appreciations and interpretations of the lives and services of our deceased associates as possible.

"Placing on record the services of deceased members to the profession of engineering is one of the most obvious evidences of appreciation that a Society can show. To whom shall the profession and the world look to perform this service if not to the Society, loyally supported during his lifetime by the individual whose work is done? In maintaining a high standard of authoritativeness, completeness, and understanding in these records every member can assist by devoting time and thought to requests for information that may come to him from the Committee on Publications. To those who have given such assistance in the past, the Committee is profoundly grateful."

The Society's biographical file is one important treasure of personal data. It helps every member while he is alive in self-evident ways. Its assistance for his memoir is hardly an argument that appeals to his selfish instincts; nevertheless that help is appreciated by others and adds one more reason why members should keep their biographical data complete and up to date in the Society's files.

Applications for Membership in the Society Continue to Increase

The sharp upward trend in applications for Society membership may be a sign of improved conditions among civil engineers in general, or it may be a sign of the esteem generally accorded membership in the Society. In the June issue of Civil Engineering, page 388, it was shown that early in May applications were substantially ahead of the last two years, standing at about one-half of the average attained in the pre-depression period. Applications are coming in now at an even faster rate.

The summer influx, which is made up principally of those who were graduated from engineering schools in June, was almost tumultuous this year. Early in August, the rate equaled the all-time high, which occurred in the summer of 1928. Specifically, on August 13 applications for all grades were 37 per cent in excess of the 1934 figure and more than two-thirds of the pre-depression average. The charts (Fig. 1) reproduced from the June issue and brought up to date, tell the story. The small chart shows the summer influx.

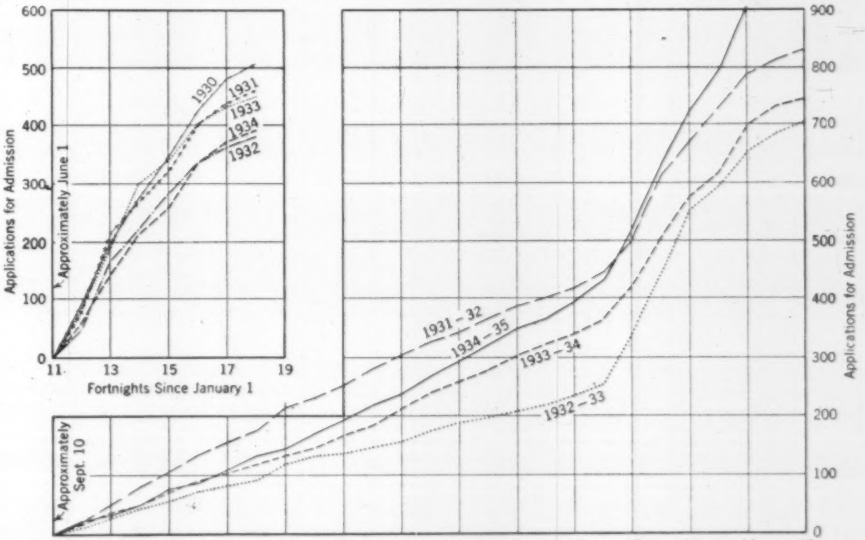


Fig. 1. Applications Received, by Fortnights Numbered from January 1

Improvements Proposed in U. S. Weather Bureau

Résumé of Recommendations of Science Advisory Board and Its Special Committee

By J. B. LIPPINCOTT, M. AM. SOC. C.E.

MEMBER, COMMITTEE ON METEOROLOGICAL DATA OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS; MEMBER, COMMITTEE ON THE WEATHER BUREAU OF THE SCIENCE ADVISORY BOARD; CONSULTING HYDRAULIC ENGINEER, LOS ANGELES, CALIF.

The Society's Committee on Meteorological Data was appointed by the Board of Direction in April 1931, with Donald M. Baker, M. Am. Soc. C.E., as chairman, to "give thought as to how the U. S. Weather Bureau could be made a greater service to engineers." Reports of this committee, suggesting numerous desirable improvements, have been published in "Proceedings" for January 1933 and in "Civil Engineering" for March 1934. In July 1933, President Roosevelt named a distinguished group of scientists to form the personnel of the new Science Advisory Board. One of the early acts of this board was to appoint a Committee on the Weather Bureau. In its report dated November 13, 1933, this committee gave consideration to the suggestions of the Society's committee previously referred to. The Science Advisory Board made a further report for the period July 31, 1933, to September 1, 1934, covering the work of its Special Committee and making certain recommendations. With the approval of Secretary of Agriculture Wallace, the Science Advisory Board later enlarged its Special Committee by the appointment of two additional members, one of whom is Mr. Lippincott. The enlarged committee met with Director Gregg of the Weather Bureau, August 8 to 10, 1935. Its findings, as well as those of the groups previously mentioned, are abstracted in this article by Mr. Lippincott for the information of members of the Society.

UNDER Executive Order No. 6238, on July 31, 1933, President Franklin D. Roosevelt appointed the Science Advisory Board under the National Research Council, as follows:

"The National Research Council was created at the request of President Wilson in 1916 and perpetuated by Executive Order No. 2859, signed by President Wilson on May 11, 1918. In order to carry out to the fullest extent of the above Executive Order there is hereby created a Science Advisory Board with authority, acting through the machinery and under the jurisdiction of the National Academy of Sciences and the National Research Council, to appoint committees to deal with specific problems in the various departments."

The President named a distinguished group of scientists to act on this Advisory Board. This Science Advisory Board appointed a special committee on the Weather Bureau, which committee made a preliminary report on November 13, 1933, which is contained in the report of the Science Advisory Board of July 31, 1933 to September 1, 1934. The members of this special committee were:

Dr. R. A. Millikan, chairman, of the California Institute of Technology
Dr. Karl T. Compton, president of Massachusetts Institute of Technology
Dr. Isaiah Bowman, president of Johns Hopkins University
Mr. Charles Dana Reed, Senior Meteorologist, U. S. Weather Bureau

In the report of this last-named committee, they reviewed the great importance of the Weather Bureau to the general public. They made "major recommendations" as follows:

"The two most important recommendations of this Committee are:

"1. That provisions be made at once for extending the so-called air-mass analysis method over the United States, through the cooperation of the Weather Bureau, the Army and the Navy, as outlined below.

"2. That the whole system of recording and reporting meteorological data in aid of forecasting be consolidated under the Weather Bureau (except for the activities necessary to the Army and the Navy)."

The following extracts are also taken from this report:

"Since urban exposures are rather unsatisfactory due to radiation and turbulence effects, it is suggested that all instruments, the readings of which are to be used in mapping, be placed at air ports since these are usually better situated for this purpose."

"The Committee further recommends a certain decentralization of the general forecast work of the Weather Bureau....."

"The Committee further recommends that a system of 'postgraduate' training for Weather Bureau meteorologists be inaugurated."

"The expense of this instruction would not be large. Also, a system of 'exchange' with meteorologists of outstanding foreign meteorological institutes should be worked out, and an effort made to maintain a strong technical staff at Washington and at a few of the leading field stations, in order to keep fully abreast of important developments in the field of meteorology....."

"The Committee further recommends that a permanent Weather Bureau Committee, composed of four or five of the outstanding scientists of the country, be set up, the functions of which shall be to keep continually in touch with the work of the Weather Bureau."

The important questions to be given consideration by the Advisory Committee would be:

"1. The proper location and distribution of aerological stations.
"2. The training of personnel.
"3. The testing, selection and development of the most suitable aerological instruments.
"4. Research projects, particularly those looking toward the development of long range forecasting methods."

The Science Advisory Board itself reviews the report of its Special Committee on the Weather Bureau and states that its Special Committee discussed and conferred with the Department of Commerce, the Army, and the Navy.

"It (the Special Committee) gave consideration to a recent report on the Weather Bureau by a committee of the American Society of Civil Engineers."

The Board further states:

"As a result of these efforts the Science Advisory Board submitted to the Secretary of Agriculture on November 17, 1933, a preliminary report on the service of the Weather Bureau, with recommendations for reorganizing this service in several important respects to take advantage of improved technique and new opportunities for increasing the accuracy and probably the range of forecasting, and it was able to report that these recommendations had received the unanimous approval of all experts consulted and the agreement of the administrative officers in all departments of the Government which were concerned, to cooperate in making the proposed reorganization successful and economical."

Quoting again:

"In conformity with the recommendations of the Board, the Weather Bureau established some 20 aerological, or upper air, stations in the United States, with the cooperation of the Air Corps of the Army and the Bureau of Aeronautics of the Navy, at each of which airplane flights are made daily and reports submitted on temperature, pressure, wind direction and other meteorological conditions useful to the application of air-mass analysis to weather forecasting, in order to increase both the period of the forecast and its accuracy."

The Science Advisory Board recommended:

"Mr. Willis R. Gregg as successor to Dr. Charles F. Marvin as Chief of the Weather Bureau. Mr. Gregg has been appointed to this office."

Secretary of Agriculture Wallace acted on the recommendations of the Science Advisory Board that a permanent advisory committee on the Weather Bureau be set up for the purpose of bringing competent outside advice to the Secretary and to the Chief of the Bureau in connection with problems of program, organization, personnel, and such.

The Secretary requested that the existing committee of the Science Advisory Board on the Weather Bureau continue to function temporarily as this advisory committee, pending other arrangements being considered by the administration for the setting up of advisory committees to the more important scientific bureaus of the government.

With the approval of Secretary Wallace, Prof. D. H. Hughes of Iowa State University was added to the Special Weather Bureau Committee of the Science Advisory Board as a representative of agricultural interests, and J. B. Lippincott was also added to represent the engineering profession.

The new director of the Weather Bureau, Willis R. Gregg, who succeeded Dr. Marvin as chief, was promoted from the Forecasting Division. Director Gregg has whole-heartedly entered into the spirit of improving the Service. He recognizes that the Weather Bureau, as an organization, is not now functioning as efficiently as it should and that it is not providing service in the detail and completeness, nor of the character that the public demands and has a right to expect.

The enlarged advisory committee on the Weather Bureau appointed by the Secretary of Agriculture met with the director of the Weather Bureau August 8 to 10, 1935, inclusive. The committee prepared a report which was personally presented to the Secretary of Agriculture, from which the following quotations are taken:

"1. *Personnel.* The foremost consideration in the effectiveness of any organization is the development, stimulation and improvement of the personnel of the organization and this is peculiarly true of the Weather Bureau, both because of its past history and because of the nature of the services rendered, such as absence of outside competition, routine character of much of its work and relative isolation of many of its personnel. The Committee feels therefore that the first and most important element in its report should deal with the problem of increased effectiveness in the inspection and stimulation of the Weather Bureau personnel from top to bottom. To increase the intimate knowledge of the Chief of the Weather Bureau and of members of his staff with personal characteristics and abilities of the groups under their supervision, and reciprocally to correlate and stimulate the members of the staff and continually to standardize their operations along the lines of the best current practices, the Committee recommends that special attention be given to an increased number of inspections and conferences within the Bureau itself, and it repeats its former recommendation that as soon as possible provision be made for giving selected members of the Weather Bureau opportunities to participate for periods of time in the activities of meteorological research centers outside of the Bureau. Certain additions to the staff and classification adjustments are urgently required."

"2. *Forecasting.* The Science Advisory Board has already recommended a more active development of forecasting. This recommendation has been adopted and an excellent start made toward its realization. The two main remaining elements that are involved in the carrying out of such a program are first, the furnishing of four weather maps a day in place of two, and second, the extension of the upper air wind, temperature and humidity service. The Committee understands that the necessity for these extensions has been recognized by the Department of Commerce, the War Department and the Navy Department, and that these extensions are in accord with the recommendations of these Services."

"The objective of these recommendations is a forecasting service improved in both accuracy and time range, and is in the interest of agriculture, commerce, aerial and marine navigation, land transportation and all other activities which depend upon weather forecasts and warnings."

"3. *Agricultural Meteorology.* It is recognized that agricultural production and marketing are exposed to weather hazards to a greater degree than any other industry or group. One of the most far-reaching public services the Weather Bureau can render is the interrelated weather and crop forecasts. There is need for an expansion of present facilities for obtaining and analyzing agricultural-meteorological and phenological observations."

"4. *Climatological Services.* For the wise planning and administration of many important governmental and private engineering enterprises, such as soil conservation, land classification and use, the utilization of the weather and crop service, protection against fire and flood hazards, etc., there is urgently needed an analysis of existing climatological data and the addition of new climatological data in critical areas. Many of the activities of the Government are such as to make unprecedented demands for this type of service."

"In connection with all of these services there is involved not only the rendering of the routine service, but also the simultaneous development of improved methods and services through new research undertakings."

Mr. Gregg has been the director of the Weather Bureau now for some 15 months and has made marked progress. He is wholeheartedly cooperating with the members of the Science Advisory Board for the improvement of this Service.

As the appropriations of the Weather Bureau were reduced from $4,164,000 for the year 1933 to $3,164,000 for the year 1935, it will be necessary, in order to restore and improve the Bureau, that a substantial increase of its present funds be appropriated by Congress. The importance and broad ramifications of its work are of such value to the nation that public necessity requires a more generous financial treatment. Director Gregg deserves the support of the Society in his efforts.

How the Society Gets a "New Deal"

Constitutional provisions against reelection make a partial "new deal" an annual occurrence with the American Society of Civil Engineers, for not only does the Society select a new President each year, but it replaces 2 of its 4 Vice-Presidents and approximately one-third of its 19 Directors as well. Once in three years each District elects a Director and every other year each Zone elects one Vice-President.

In all voluntary associations, the ratio of the number of votes cast to the number of eligible voters is sometimes small. On the "first ballots," in the District elections that have been held since 1932, returns were made in one District by as few as 9.5 per cent of the Corporate Membership; the highest percentage return was 33.5 and the median, 15. The return on "second ballots" has ranged between 17.8 and 43.7 per cent, with a median of 30. Final balloting (by the entire Society) drew a response from 26.8 per cent of the corporate membership in 1932, from 24.0 per cent in 1933, and from 23.2 in 1934.

A consideration of the purposes of the three ballots required before election suggests, however, that a small vote may be no indication of a lack of interest. The first ballot, mailed in June and canvassed on August 1, is a preliminary, nominative one, on which each member is free to insert the name of any person he may choose as candidate for Director from his District or Vice-President from his Zone. It is not surprising that such a ballot brings a comparatively small return. The second ballot, mailed during August and canvassed October 15, lists all members who received 5 per cent or more of the votes cast in the first ballot. This second vote determines the "official nominee," and, as has already been seen, is participated in by about twice as many members as is the nominative ballot. The average percentage of members voting it, would doubtless be still higher if it did not so frequently happen that only one name survives the first ballot; in such cases the second vote becomes merely a constitutional formality.

These first two ballots go only to members in the Districts or Zones electing, although the entire membership is apprized of their results. A distinctive feature of Society government, however, requires that the proposed Director of each District and Vice-President of each Zone, and also the proposed President, be approved by the entire membership of the Society before he finally takes his seat on the Board of Direction. The "final ballot," therefore, going to all Corporate Members regardless of location, contains the name of the official nominee for each vacant directoral or vice-presidential post.

This final ballot, mailed early in December, carries also the name of the official nominee for the presidency, who has meanwhile been selected by the Nominating Committee, and the names of any nominees "by declaration." "Nomination by declaration" is a constitutional provision permitting any 25 or more Corporate Members to nominate an additional candidate for President by filing with the Secretary a signed declaration and the nominee's acceptance. Any 25 or more Corporate Members residing in any one District or Zone can in the same manner place in nomination an additional candidate for the office of Director or Vice-President for that District or Zone.

As nomination by declaration is rather uncommon, the final ballot usually carries the name of only one nominee for each office, and it is not surprising that only one-fourth of the corporate membership sees fit to return it. It should be pointed out, however, that members are permitted to replace any name on the final ballot with any name of their own choosing.

All voting is conducted in absolute secrecy. A member, after preparing his ballot, places it in a plain envelope, seals that, and encloses it in an envelope addressed to the Society, signing his name on the back of the latter. This ensures that no ballots submitted by persons ineligible to vote will be counted. The names are checked upon receipt at Headquarters. Ballots having no exterior means of identification are discarded. However, if the voter's name appears—but stamped or lettered rather than signed—the ballot is returned with a request that it be endorsed in accordance with the Constitution.

Ballot envelopes, unopened, are separated into Districts and filed alphabetically, ballots of members in arrears being withheld from canvass unless dues are paid. The alphabetical cataloging makes it possible for any member to withdraw or change his ballot at any time before the counting.

Counting, or "canvassing," is done at Society Headquarters under the supervision of a committee of tellers appointed by the President. On the day provided in the Constitution for the canvass, under the supervision of the chairman of the tellers, the ballot envelopes are run through a cutting machine. The blank inside envelopes are removed and the outer envelopes, bearing the signatures, are later destroyed. The removal of the outer envelopes thus removes the last vestige of identification. The blank envelopes in turn are run through the cutting machine, and the ballots are removed and tallied by the committee.

American Engineering Council

The Washington Embassy for Engineers, the National Representative of More Than 200 National, State, and Local Engineering Societies Located in 40 States

NOTES ON NEW LEGISLATION

IN FOUR months Congress will reassemble. In the interval between now and the first of January 1936, it is the task both of industry and of the federal agencies to adjust themselves to the heavy load of legislation. Both Washington and the country are reviewing with soberness the results of emergency legislation passed during the previous sessions of Congress. There are certain to be difficulties in the way of putting some of the legislation into effect. There continues to be much confusion in Washington and a growing feeling on the part of those responsible for administering the legislation that there is a big difference between having new ideas and putting those new ideas into action.

Much of the new legislation, conerning as it does natural resources, transportation, and construction, directly affects engineers and engineering development. The regulatory legislation covering utility holding companies, motor carriers, the soft coal industry, and "hot oil"; and the increased powers of TVA and AAA, all tend to centralize authority in Washington over industrial practices and procedure.

The legislation dealing with labor, especially that tending to establish the procedure for collective bargaining by labor as well as the "social security" system of old-age pensions and unemployment reserves, brings new problems to engineers and to industries employing engineers, insofar as the centralization of regulatory legislation in Washington tends to open channels for constructive study of industrial practices and procedures. Probably in the next ten years many new fields of opportunity for engineers will be opened, not in the government, but in private industry, because of the need of more intensive analysis of manufacturing costs, of relation of machinery to reduction of labor costs, and of manufacturing methods. Undoubtedly also, there will be an increase in the use of power per man.

Among the measures on which final action was not reached by Congress are Senator Lewis's bill to change the name of the Department of the Interior to "Department of Conservation and Works," the Walsh bill to regulate hours and wages on government contract work, and the Wagner proposal to make it unlawful for persons other than lawyers to make representations before federal agencies. All bills keep the same status into the next sessiont hat they attained prior to the recent adjournment.

THE WORK RELIEF PROGRAM

Over the past month, hundreds of projects have been approved by the Works Progress Administration, Public Works Administration, and other federal units. Thousands of additional projects were in the federal hopper on the September 12 deadline set by the President for receipt of applications. In order to spur the program forward toward the winter peak, the federal, state, and local agencies have been instructed to put the projects on contract or force account work by October 22 and to let all necessary contracts not later than December 15.

Under decentralized control, with responsibility largely in the hands of federal personnel in each state, the program invites more than ever the constructive aid of engineering societies and local sections in supplying unbiased advice along technical lines. The fact that services of engineers and contractors may be used on a fee and contract price basis will enable engineers in private practice to enter the program without sacrificing their present business.

Engineering employment under the program may be expected to show a net gain as field activities expand. Some opportunities also may develop under the new administrative staffs required by new legislation including social security, utility holding companies, coal mining, and motor carriers, but the failure of the Third Deficiency Bill in the last hours of Congress may delay the building of these organizations until after Congress meets in January. These and other acts of Congress have broadened the discretionary power of the Administration and the pending interpretations of the new powers are likely to include decisions of engineering importance.

The PWA loan rate for non-federal work, on the 45 per cent grant and 55 per cent loan basis, was reduced from 4 per cent to 3 per cent on May 24, but later was returned to 4 per cent. Continuation of the old rate is for the purpose of encouraging communities to use private capital in the financing of reemployment construction projects. Among the non-federal projects recently approved, 130 projects totaling more than $40,000,000 will receive the 45 per cent grant, while the applicants are using their own credit sources for the remaining 55 per cent.

After a PWA project has been approved, the present regulations permit funds to be made available so that mutually satisfactory fees may be paid for engineering purposes, such as preliminary surveys, plans, and specifications.

High lights of work relief developments over the past month, in addition to the heavy volume of new projects approved under WPA, touch upon many fields of engineering activity. River and harbor and flood control measures are going forward on a large scale under the Corps of Engineers. The Chicago Sanitary District is undertaking the largest sewerage program in the world with new PWA allotments, bringing the total nearly to $60,000,000. The Second Deficiency Act, approved August 12, releases $60,000,000 for public buildings. The Soil Conservation Service has announced a $27,500,000 program in 42 states. Under a $98,830,000 program for balanced land use, the Bureau of Reclamation will undertake additional projects, while ten acres of land for every one reclaimed is to be retired from production under the Forest Service and the Resettlement Administration.

Secondary roads will receive not less than $50,000,000 of the $200,000,000 alloted for highways from the $4,880,000,000 fund. The PWA Housing Division has under way 76 projects of the slum clearance, low-rent housing type, and has been acquiring new sites. Additional housing plans are being developed by several agencies. A power division under PWA is giving special attention to applications from municipal plants. New surveys by the Bureau of the Census offer engineering opportunities along statistical lines. General collection of data, together with planning work, is continuing under the National Resources Committee and the Water Resources Committee.

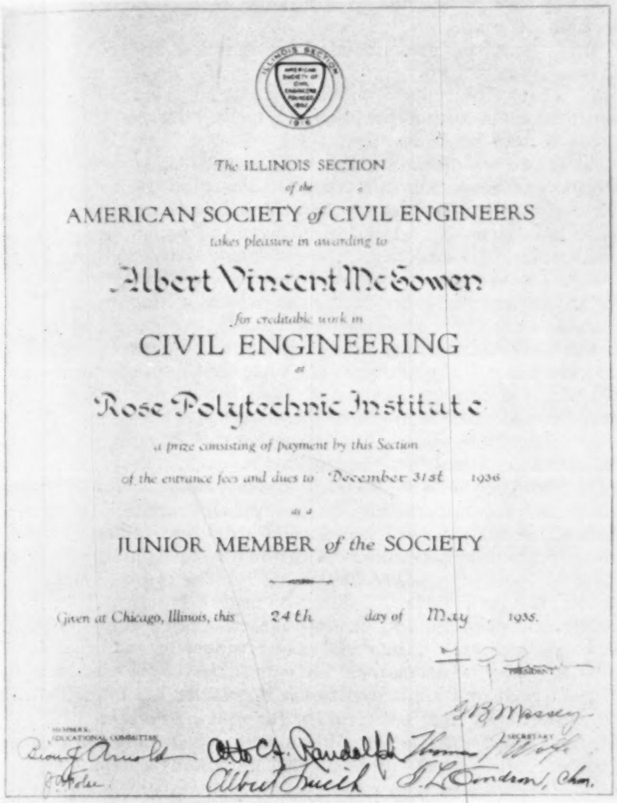
The soil and foundation survey of New Orleans, being carried on as a federal project under sponsorship of the Louisiana Engineering

Society, is reported as making good progress. Engineering societies wishing to have similar work done in their areas may consult local and state engineers of the Works Progress Administration.

Washington, D.C.
September 15, 1935

Students Receive Local Section Awards

During the 1935 commencement season many of the Local Sections of the Society followed their annual custom of presenting awards for high scholastic distinction to engineering students graduating from colleges and universities within their territories. The award takes the form of Junior membership in the Society, the Local Section paying the initiation fee and dues for the first year. To date the following prize winners for 1935 have been reported to Society Headquarters:



The ILLINOIS SECTION
of the
AMERICAN SOCIETY of CIVIL ENGINEERS
takes pleasure in awarding to
Albert Vincent McEowen
for creditable work in
CIVIL ENGINEERING
at
Rose Polytechnic Institute
a prize consisting of payment by this Section
of the entrance fees and dues to December 31st 1936
as a
JUNIOR MEMBER of the SOCIETY

Given at Chicago, Illinois, this 24th day of May 1935.

PRESIDENT
G. B. Massey
SECRETARY
MEMBERS EDUCATIONAL COMMITTEE
Arnold
Randolph
Albert Smith
T. L. Condron, Chm.

Typical Certificate of Award

Name of Student	College	Local Section Giving Award
Walter Melvin Enger	University of Illinois	Central Illinois
Albert MacCullough Levy		
Gordon Joseph Lindl		
Merton Dudley Corwin	University of Cincinnati	Cincinnati
William L. Blankenburg	Case School	Cleveland
Frank F. Fricker	Akron University	
Martin Philip Capp	University of Colorado	Colorado
William Powell Walker	University of Florida	Florida
Howard Mayfield Hinton	Georgia School of Technology	Georgia
Herman Sidwell Smith	State University of Iowa	Iowa
Carl Arthur Post	Iowa State College	
Clarence W. Buren	Lewis Institute	Illinois
Eigill R. Fadum	University of Illinois	
Compere Loveless	Purdue University	
James M. Mitchelhill	Northwestern University	
Albert V. McEowen	Rose Polytechnic Institute	
George A. Nelson	Armour Institute of Technology	
Robert Roe Sheridan	Cornell University	Ithaca
Fred Jacob Benson	Kansas State College	Kansas State
Carl Edward Kindsvater	University of Kansas	
William Howard McDill	Missouri School of Mines	Kansas City
Harold Jay Corwin	Lafayette College	Lehigh Valley
Forest Clarence James Purnell	Lehigh University	
Ray Gunnar Johnson	University of Southern California	Los Angeles
Paul Louis Kartzke	California Institute of Technology	
Lionel Grant McCray	University of New Mexico	New Mexico
Thomas E. Utterback	New Mexico State College	
James E. Czel, Jr.	State College of North Carolina	North Carolina
Walter Winburne King	University of North Carolina	
Howard William Schleiter	University of Minnesota	Northwestern
Edward Silberman	University of Minnesota	
Cline Lee Mansur	University of Oklahoma	Oklahoma
John William Comer	Oklahoma Agricultural and Mechanical College	
John H. Michener	Drexel Institute	Philadelphia
H. F. Redmile	University of Delaware	
Wallis Sylvester Hamilton	Carnegie Institute of Technology	Pittsburgh
George Reinhart Gray	University of Pittsburgh	
Charles Skiles Dumble	Oregon State College	Portland (Ore.)
John Worth McReynolds	University of Missouri	St. Louis
Jos. W. Graves, Jr.	Washington University	
Alan A. Lischer		
Richard A. Hattrup	Stanford University	San Francisco
Chester Woo	University of California	
Franklin Edward Smith	University of Idaho	Spokane
Howard Arthur Russell	Stanford University	Sacramento
Robert Benton Allen	University of Utah	Utah
Charles Victor Thornton	University of Utah	
Elmo Rich Morgan	Utah State Agricultural College	
H. Cletus Broyles	Virginia Polytechnic Institute	Virginia
Lawrence John DeMeo	Virginia Military Institute	

Student Chapters at Illinois and Tulane Present Outstanding Reports

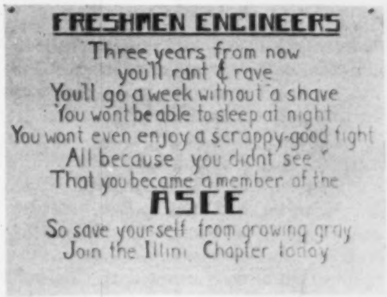
Outstanding among the Student Chapter reports for the 1934–1935 term recently received at Society Headquarters are those of the University of Illinois and of Tulane University, respectively the largest and one of the smallest of the Chapters.

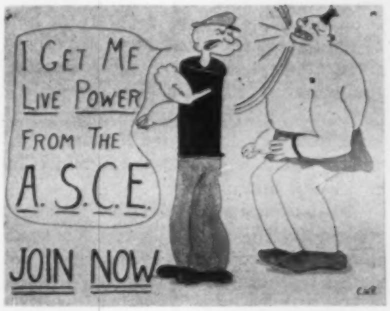
The Illinois report, which is some 30 pages in length, is profusely illustrated and contains, in addition to a résumé of the year's activities, a detailed explanation of Chapter objectives and methods.

It is quite evident that student members at Illinois do more than attend meetings. Witness the following excerpts from the report:

"The Chapter aims: (1) To acquaint the student with the practical phases of engineering and to develop in him a professional point of view; (2) to provide for and foster a fraternal spirit among engineering students; (3) to familiarize the student with the purpose, parliamentary procedure, and the objectives of a professional engineering society; (4) to encourage, support, and promote student publications, and professional and social activities of the College of Engineering; and (5) to arrange for, and sponsor, inspection trips."

"It has always been the custom of the Chapter to have the speaker as guest of honor at a luncheon ...; heretofore the others


FRESHMEN ENGINEERS
Three years from now
you'll rant & rave
Youll go a week without a shave
You wont be able to sleep at night
You wont even enjoy a scrappy-good fight
All because you didnt see
That you became a member of the
ASCE
So save yourself from growing gray
Join the Illini Chapter today



Posters Prepared by University of Illinois Student Chapter present have been a mixed group of faculty and students. In an effort to make the students more dependent upon themselves, a new arrangement was innovated this year, whereby at the majority of these luncheons and dinners only students were present: in this way the students could not fall back on the faculty to entertain the speaker during the meal but had to exercise their own initiative and ability along this line."

"The primary purpose of the publicity committee is to announce present and future meetings of the Chapter and properly bring these announcements to the attention of all who may be interested. To this end the committee worked through four different mediums: (1) A poster for each speaker placed on a bulletin board outside the west entrance to Engineering Hall; (2) the daily newspapers; (3) printed signs placed on bulletin boards in the various buildings of the engineering college, and in two instances in every building on the university campus; (4) a typed card, giving the name, business connection, and subject of the talk of the speaker, with a request that the meeting be announced in classes, sent to each faculty member of the department of civil engineering...."

Two of the posters used in the Illinois membership campaign are reproduced here.

Of interest in the Tulane report is the detailed description of the Chapter's 17 meetings and 5 inspection trips. A news article, also, invites especial consideration, bringing out clearly the value to the Society of its Student Chapters:

"A recent survey of the senior class disclosed that it is the intention of every member, with one exception, to join the American Society of Civil Engineers. The exception referred to, is one member of the class who has passed the age of 33, and is therefore not eligible for membership [as a Junior]. We are particularly proud of this 100 per cent record, and feel that a great part of the interest shown in the Society is due to the activities of the Student Chapter. Included in this group are two men who completed their courses last year, but who are receiving their diplomas with this year's class, making a total of eight men joining the Society."

Additional items concerning the Tulane and Illinois Student Chapters appear in "Student Chapters Notes."

Indexing "Transactions"

VARIOUS SECTIONS of the current issue of TRANSACTIONS, shortly to be mailed to members, have been on the presses during the summer. This volume, numbered 100, seems to round out a definite cycle so that one looks for significant features. One such feature is the indexing.

All the volumes are indexed individually. In addition an index issued in 1920 was cumulative of all previous volumes, and another last year included the term 1921–1934. Thus three indexes cover the entire 100 volumes to date. They bear the impress of constant and single supervision, under Miss Eleanor H. Frick. Formerly as Society librarian, and now for many years as office manager, she has been in close contact with this work for 38 years.

Life Story of a "Proceedings" Paper

TO AN AUTHOR awaiting word of what disposition has been made of his paper, the lapse of time before this is finally known sometimes appears inexplicable. Even after acceptance, a delay sometimes occurs before publication, which may prove irritating to the author. This review of the course of a manuscript through Society Headquarters is intended not only to explain some of the apparent delays but to suggest ways in which the author can help to reduce them to a minimum.

When a manuscript is submitted for PROCEEDINGS, it is first sent for review to several experts. These are selected from a list of more than 300 members scattered throughout the United States, especially qualified in the particular branch or branches of the profession involved. The choice in any particular case depends upon the subject treated by the paper. Before being sent out, the paper is made anonymous; that is, all marks of identification are removed, except of course chance indications of authorship inherent in the text.

This reviewing service, performed gratis, is nevertheless very thorough. Papers are not simply read over hurriedly and checked as "favorable" or "unfavorable"; they are studied carefully and commented on in detail. The remarks of a commentator may be as extended as a discussion in PROCEEDINGS and may necessarily require considerable time to prepare. As a result a number of weeks may elapse before the comments are returned. If sufficient copies of the paper have not been furnished by the author to permit the proper number of concurrent reviews, still more time is of course needed, since the cost of preparing additional copies is prohibitive.

When all the reviews have been made, a report is prepared for the Committee on Publications, giving a synopsis of the paper, a summary of the comments, and an estimate of the cost of printing. At the next regular meeting of the committee this report is presented and, after discussion, appropriate action is taken. Any one of six general lines of action may be adopted:

1. The paper may be accepted for publication in PROCEEDINGS with routine editing, in line with reviewers' suggestions.
2. It may be returned to the author for revision and resubmission.
3. It may be referred to additional experts for comment, and decision deferred.
4. It may be recommended for revision and publication in CIVIL ENGINEERING.
5. It may be refused publication but accepted, subject to the approval of the author, for filing as a technical paper in the library.
6. It may be declined.

Some of these lines of action may require explanation. Papers receiving considerable adverse criticism may still be accepted without revision, but where the criticism is of a fundamental nature, it is generally advisable to have the papers revised before publication. In such cases, the comments that are transmitted to the author are anonymous, and the Society acts as intermediary for author and reviewers during the process of revision.

Refusing a paper for publication but accepting it for filing is not in itself indicative of lack of merit in the paper. Such action may be taken if the article is too long for PROCEEDINGS and does not admit of condensation, or if it treats a subject which it is believed has already been allowed sufficient space.

After final acceptance of a paper the work of editing can begin, on manuscript and on illustrations as well. Treatment of the latter, however, is to be discussed in a succeeding issue and will only be considered superficially in the present article. With some papers, bringing the written material into shape amounts to little more than making minor adjustments to conform with the style of PROCEEDINGS, and retyping for the printer's use. With others, the revision may include correcting grammar, clearing up ambiguous wording, and deleting material easily found elsewhere. With still others, a basic revision of arrangement and considerable rewriting may be necessary. On completion of the editing, a copy of the edited revision is sent to the author for his approval. This is the author's final opportunity for making corrections. When finally ready for the printer, the paper is held only until space is available in PROCEEDINGS. The remaining steps of typesetting and proof-reading have no unusual features.

The preceding paragraphs should have made it clear that a manuscript does not lie idle for any great part of the time before publication. What then can the author do to expedite matters? In addition to carefully adhering to the suggestions on page 47 of the *Year Book*, he may find the following points helpful:

1. Current practice of the Society calls, in general, for the review of papers by three or more experts. Consequently, at least three copies of the paper should be submitted.
2. Editorial work may be reduced to a minimum by giving careful attention to logical arrangement and to the style prescribed for PROCEEDINGS papers in the pamphlet, *General Information on Society Publications and Preparation of Manuscript for* PROCEEDINGS. This pamphlet is obtainable from Society Headquarters.
3. In so far as practicable, drawings should be prepared especially for the article and the use of working or detail drawings designed for another purpose should not be attempted. Unnecessary details are confusing at the reduced scale necessary in PROCEEDINGS illustrations. Particular attention should be given to line work. The original copy should be about twice the size of the finished reproduction and should be drawn in black india ink on a plate-surface drawing paper or on tracing cloth. Lettering may be done in pencil, as all drawings are relettered by the Society in the interest of uniformity of appearance. Drawings will be discussed in more detail in a future issue.
4. Papers should be within the word limit of 22,000 words, including pictures and cuts estimated at 550 words per page.

Preview of Proceedings

By HAROLD T. LARSEN, *Editor*

Because of an overflow of discussions awaiting publication after the summer recess, it was found not feasible to publish all the papers promised in the September preview. The publication of a number of discussions was also deferred. Therefore, in addition to four new papers, the October issue of "Proceedings" will contain considerable discussion on the following papers: "Structural Beams in Torsion," by Inge Lyse, M. Am. Soc. C.E., and Bruce G. Johnston, Jun. Am. Soc. C.E.; "The Shear-Area Method," by Horace B. Compton, Assoc. M. Am. Soc. C.E., and Clayton O. Dohrenwend, Jun. Am. Soc. C.E.; and "Photo-Elastic Determination of Shrinkage Stresses," by Howard G. Smits.

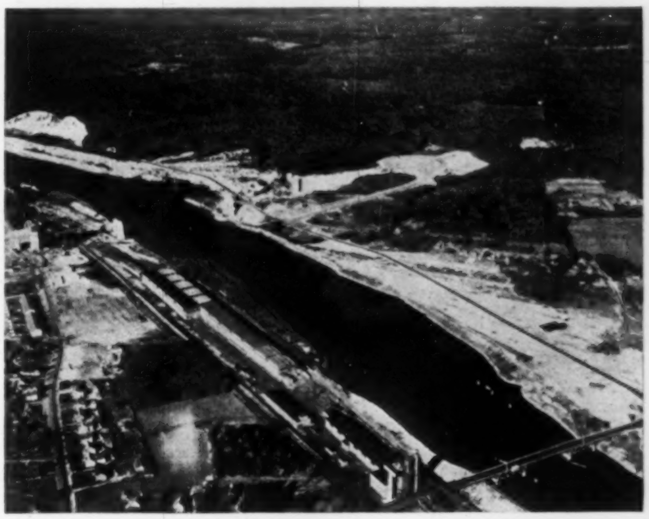
TAPERED STRUCTURAL MEMBERS: AN ANALYTICAL TREATMENT

The beam with a variable cross section—that is, the tapered structural member—is always a matter of great interest to structural designers. With increased facility in designing indeterminate structures, the tapered member has become increasingly important, because this shape is in every respect the correct design for a beam with restrained ends. A forthcoming paper by Walter H. Weiskopf and John W. Pickworth, Associate Members Am. Soc. C.E., entitled "Tapered Structural Members: an Analytical Treatment," should prove of unusual interest from this point of view. The authors approach their problem by introducing, for the actual moment of inertia of a member, a function of x such as to produce a curve closely approximating the actual I-curve and presented in such a form that the expression $M\,dx/EI$ can be integrated easily. Outlining the general theory, the authors proceed to demonstrate a number of applications of their analysis to various design methods, such as the method of least work, the slope deflection method, and the Cross method of distributing fixed-end moments. These methods require the use of certain tabular constants, such as those termed "taper constants" and "F-terms." The latter are given in detail for five different classes of beams. The paper ends with a brief outline of an approximate solution, using the broad theories advanced by the authors in this paper.

PROPOSED IMPROVEMENT OF THE CAPE COD CANAL

Since 1697 plans had been propounded for the construction of the canal across Cape Cod. Construction work on the present canal began in earnest in 1909, and the canal was opened to traffic in 1914. In a paper entitled "Proposed Improvement of the Cape Cod Canal," by Lt. E. C. Harwood, to be published in the October PROCEEDINGS, the entire problem of future improvements on the canal is analyzed. An imposing array of social and commercial reasons for further widening and other improvements is included. Lieutenant Harwood analyzes the traffic through the canal in relation to the total traffic in and out of the Port of Boston and discusses the economy of several alternate suggestions.

DRIVING PILES IN UNWATERED COFFERDAM, FOR NEW RAILROAD BRIDGE, CAPE COD CANAL



SITE OF THE NEW SAGAMORE BRIDGE, CAPE COD CANAL
Abutments Are Visible in the Background

A view of one section of the present canal, illustrated here, shows one of the new bridges across the canal under construction. A number of interesting problems are encountered in the construction of these bridges, of which two are highway structures and one is a railroad bridge. In some cases, the foundation material was loose and flowed easily. Although it was not originally intended to drive piles in these foundations, this condition indicated that they would be desirable. For the highway bridges they were driven under water, whereas in the case of the new railway bridge, shown in the accompanying illustration, the caisson was pumped out and the piles were driven in the unwatered cofferdam.

THE RELATION OF ANALYSIS TO STRUCTURAL DESIGN

The leading paper scheduled for the October issue of PROCEEDINGS is entitled "The Relation of Analysis to Structural Design," by Hardy Cross, M. Am. Soc. C.E. The contents of this interesting paper were outlined very briefly in the September preview.

TUNNEL AND PENSTOCK TESTS AT CHELAN STATION, WASHINGTON

Another paper originally planned for the September number of PROCEEDINGS and finally scheduled for the October issue, is "Tunnel and Penstock Tests at Chelan Station, Washington," by Ellery R. Fosdick, Esq. The contents of this paper were also outlined in the September preview.

News of Local Sections

GEORGIA SECTION

At a luncheon meeting of the Georgia Section, held at the Atlanta Athletic Club on September 9, the topic of municipal finance was discussed. B. G. West, who has been comptroller of Atlanta for 18 years, spoke on "How the City Will Finance Its Bond Issue." In this talk he gave a very clear picture of the financial situation of the city. During a brief business session M. T. Singleton was unanimously elected a delegate to the Fall Meeting to be held in Birmingham.

KANSAS CITY SECTION

A meeting of the Kansas City Section was held at the Newbern Hotel on August 6, with 26 members and guests in attendance. After a business session two speakers were heard—T. A. Leisen, Director of the Society, and C. R. Van Orman, a junior engineer in the U. S. Engineer Office in Kansas City, Mo. Colonel Leisen spoke on Society activities, emphasizing particularly the subjects of Juniors and of the proposed revision of the Constitution, and Mr. Van Orman gave an interesting discussion of the technical aspects of permeable jetties and soil erosion.

District of Columbia Section

The District of Columbia Section of the Society held an informal dinner on September 11 in honor of the Honorable J. M. Johnson, Assistant Secretary of Commerce, who took up his duties, effective June 25, 1935, in charge of the bureaus of Air Commerce, Shipping Board, Navigation and Steamboat Inspection, Coast and Geodetic Survey, and Lighthouses. About 100 members of the Section and guests welcomed the opportunity of greeting him in his new capacity and extending good wishes for his success. The event took place in the Patio of the Chamber of Commerce Building. After felicitations by Arthur S. Tuttle, President of the Society, and Gen. R. C. Marshall, President of the Section, Colonel Johnson gave a short address. Then followed the regular technical program, with illustrated talks on "River Crossings in Military Operations," by Chester K. Harding, executive officer, The Engineer Board, U. S. Army; "Unusual Construction Operations, U. S. Reclamation Projects," by John C. Page, senior engineer, U. S. Bureau of Reclamation; and "Bridges of Yesterday, Today, and Tomorrow," by Dr. D. B. Steinman, consulting engineer of New York City.

John Monroe Johnson

Los Angeles Section

On August 26, a special dinner meeting of the Los Angeles Section was called to order at the University Club. There were 119 present at this session, which was held in honor of Samuel B. Morris, former president of the Section, who is leaving Los Angeles to become executive head of the civil engineering department of Stanford University. The other guests of honor were E. O. Nay, chairman of the Board of Directors of Pasadena, and C. W. Koiner, city manager of Pasadena, Calif. The list of speakers included Franklin Thomas, Professor of Civil Engineering at California Institute of Technology; Charles D. Marx, Past-President of the Society and Professor Emeritus of Stanford University; and J. B. Lippincott, consulting engineer of Los Angeles. Professor Thomas spoke on "The Changing Trend of Engineering Education"; Professor Marx discussed briefly the subject, "Qualifications of an Engineering Professor"; and Mr. Lippincott presented the progress report of the Society's Committee on Meteorological Data.

Sacramento Section

During the past summer the Sacramento Section has held regular weekly luncheon meetings, which have been well attended by both members and guests. At the session held on July 23, the speakers were B. A. Etcheverry, Director of the Society, Fred Herrmann, former Director, and Walter E. Jessup, Field Secretary of the Society. On July 30 Vice-President Dewell presented a report on the subject of a salary schedule. The speaker on this occasion was E. E. Hoss, of the Pacific Telephone and Telegraph Company, whose talk on radio broadcasting was illustrated with motion pictures. The speaker at the meeting held on August 6 was R. G. Cone, resident engineer on the Golden Gate Bridge. Mr. Cone described this project which, when completed, will be the longest suspension bridge in the world.

San Francisco Section

There were 60 members and guests present at a dinner meeting of the San Francisco Section held at the Engineers' Club on August 20. The entertainment for the evening was in charge of L. A. Elsner, who had arranged a fine musical program. Later in the evening a business meeting was called to order. During this session several committee reports were heard, and new committees were elected.

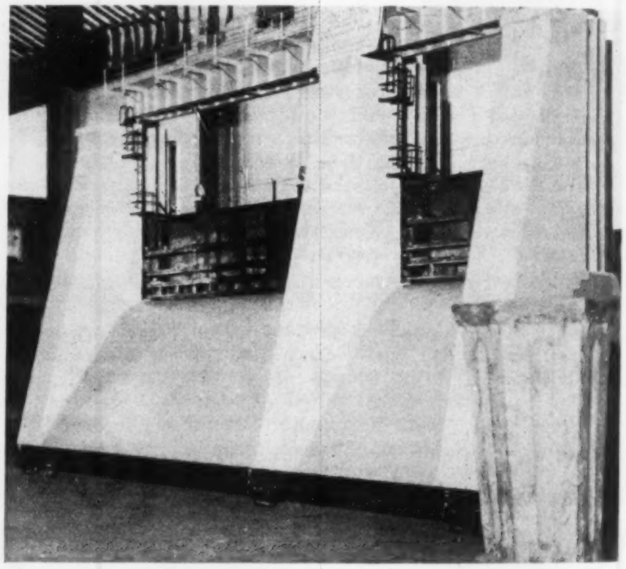
Spokane Section

The Spokane Section and the Associated Engineers held a joint meeting at the Davenport Hotel on September 4, with about 75 present. C. D. Riddle, job engineer for the Mason-Walsh-Atkinson-Kier Company, contractors on the construction of Grand Coulee Dam, gave an interesting and detailed talk on the gravel plant which will supply aggregate for the 4,000,000 cu yd of concrete to be placed by the company. The processing plant, located at the pit about a mile below the dam, will handle 2,000 tons of aggregate per hour and deliver it to mixer storage by belt conveyors. Mr. Riddle illustrated his talk with blackboard sketches and later answered many questions concerning the project. The Section is considering ways and means of increasing its activities along lines suggested by Field Secretary Jessup during his visit here on July 30.

Student Chapter Notes

University of Alabama

During the past school year the University of Alabama Student Chapter held nine sessions that attracted a total attendance of 198. Students, members of the faculty, and outside speakers presented interesting papers on these occasions. The list of outside speakers included George Little, vice-president and manager of the Baker Tow Boat Company, Inc., and H. H. Houk, state highway engineer. One of the most stimulating features of the year's activities was the engineering exhibit held on St. Patrick's Day. This display included photographs of engineering projects, maps, surveying instruments, concrete briquets, and engineering models.



Model of Proposed Dam on Warrior River Exhibited by University of Alabama Student Chapter

Antioch College

Monthly meetings were held by the Antioch College Student Chapter during the 1934–1935 school year. Among the speakers were Charles Horner, of the Superior Engine Company of Springfield, Ohio; C. A. Norman, Professor of Machine Design at the University of Ohio; G. F. Noltein, assistant chief engineer of the Superior Gas Engine Company; and Richard R. Kennedy, associate metallurgist at Wright Field, Dayton, Ohio. On April 29 members of the Chapter were guests of the Dayton Section of the Society on an inspection trip that included visits to such points of interest as a frameless steel house and the plant of the American Rolling Mills at Middletown, Ohio.

University of Arizona

In the annual engineers' edition of the student body paper the University of Arizona Student Chapter was characterized as the most outstanding and successful professional group on the campus in the school year just passed. There were 184 present at the seven meetings. A number of students presented papers on these occasions, and several outside speakers—among them Louis Fiscel, county engineer of Pinal County, and Samuel F. Crecelius, of the International Boundary Commission—gave talks. On May 17 a meeting was held in honor of the senior members of the Chapter, each of whom gave a brief talk on subjects connected with the 50th anniversary of the founding of the University of Arizona.

University of Arkansas

In the school year, 1934–1935, the University of Arkansas Student Chapter had 100 per cent enrolment of those in the university eligible for membership. Most of the 13 meetings held during the year were addressed by students, and illustrated lectures furnished by the Society were enjoyed on a number of occasions.

Brooklyn Polytechnic Institute

Two interesting inspection trips gave zest to the activities of the Brooklyn Polytechnic Institute Student Chapter during the past year. On October 26 the members observed the process of caisson construction in the tunnel being built under the Hudson River at 38th Street, and on December 8 they visited the Paterson, N.J., water works system. Among the outside speakers were Lynne J. Bevan, consulting engineer of New York, N.Y.; Arthur G. Hayden, designing engineer of the Westchester County Park Commission; and W. C. Laughlin, of the Filtration Equipment Company.

Bucknell University

The list of speakers heard by the Bucknell University Student Chapter during the past year included Willis Whited, advisory bridge engineer of the Pennsylvania State Highway Department; Lyons Mussina, city engineer of Williamsport, Pa.; and R. C. Kitner, of the chemical engineering department of the university. Illustrated lectures supplied by the Society were shown at some of the meetings. On April 17 members of the Chapter attended the student convention sponsored by the Philadelphia Section.

University of California

Varied programs of entertainment marked the 1934–1935 meetings of the University of California Student Chapter. Several dinner meetings, at which members of the faculty served as speakers, were enjoyed, and inspection trips were taken to various points of engineering interest. These included the San Francisco–Oakland Bay Bridge, the Park Street bascule bridge, and the shops of the McClintic-Marshall Company. On March 15 an open house was held in connection with the customary biennial celebration of Engineers' Day, and members of the Chapter played a prominent part in the arrangement of the exhibits shown in connection with the occasion. A membership drive, initiated at the beginning of the spring semester, was responsible for the recruiting of 127 members.

California Institute of Technology

The 1934–1935 meetings of the California Institute of Technology Student Chapter included four interesting inspection trips to local points of engineering interest. These were the Pasadena Sewage Plant, the Madison School, aerial surveying projects of the Fairchild Aerial Survey Company, and the Metropolitan Tunnel. On all trips competent guides were on hand to explain the details of the particular project and to answer questions. The feature meeting of the year was held on May 8 when the Chapter was host to the Los Angeles Section of the Society. On this occasion the speakers were Dr. R. A. Millikan and Dr. J. H. Maxson, of the California Institute of Technology.

Carnegie Institute of Technology

The Carnegie Institute of Technology Student Chapter reports that the past school year has been one of unusual engineering activity. There was 100 per cent enrolment of those eligible for membership in the Chapter, and weekly meetings were held. The total attendance at these sessions was 2,554, the programs of entertainment consisting largely of the presentation of papers by students and outside speakers. Among the latter were W. F. Hall, district manager of the Raymond Pile Company; R. A. Kirkpatrick, of the Union Pacific Railroad; R. S. Phillips, of the Portland Cement Association; A. C. Clarke, assistant chief engineer of the Baltimore and Ohio Railroad; Frank C. Jordan, director of the Allegheny Observatory; George E. Evans, superintendent of the Bureau of Building Inspection; and J. L. Herber, of the Lone Star Cement Company. On several occasions members of the Chapter attended meetings of the Engineers' Society of Western Pennsylvania.

Catholic University of America

Illustrated lectures furnished by the Society formed the nucleus of entertainment at meetings of the Catholic University of America Student Chapter held during the past year. Other sessions were addressed by students and outside speakers, the latter including Franklin G. Williams, of the Gurley Instrument Company of Troy, N.Y.; Q. A. Campbell, assistant chief engineer of the National Paving Brick Association; Alfred T. Fleming, director of conservation of the National Board of Fire Underwriters; and Ernest A. Schuster, of the U. S. Geological Survey. Inspection trips were made to the Delacaria Reservoir, the laboratories of the Aerial Survey Division of the U. S. Forest Service, and the testing laboratories of the U. S. Bureau of Standards.

University of Cincinnati

The University of Cincinnati Student Chapter boasts 100 per cent enrolment during the recently completed school year. Six meetings, with a total attendance of 120 members, were held. Some of the speakers appearing on these occasions were W. W. Carlton, senior assistant structural engineer of the Cincinnati Department of Buildings; J. S. Raffety, sanitary engineer of Hamilton County (Ohio); and Walter E. Jessup, Field Secretary of the Society.

Clarkson College of Technology

During the past school year the Clarkson College of Technology Student Chapter held seven meetings, which attracted a total attendance of 231. The programs for some of these meetings featured talks by various interesting outside speakers; at other sessions motion pictures or the illustrated lectures loaned by the Society were enjoyed. One of the high lights of the year was an inspection trip made by senior class members of the Chapter to points of engineering interest in Buffalo, Niagara Falls, and Rochester.

University of Colorado

Student papers formed the nucleus of entertainment at 1934–1935 meetings of the University of Colorado Student Chapter. Outside speakers who appeared during the year were Frank B. Cook, Jr., associate engineer for the U. S. Reclamation Service; G. M. Musick, architect of Denver; and John B. Drisko, 1927 Freeman Traveling Scholar from Massachusetts Institute of Technology. On May 13 members of the Chapter were guests of the Colorado Section at a meeting held in Denver.

Columbia University

The Columbia University Student Chapter reports the completion of a successful year in which a total of 15 meetings was held. Entertainment at these sessions consisted largely of the presentation of student papers, which covered a variety of timely topics. On one occasion T. Alfred Fleming, of the National Board of Fire Underwriters, addressed an open meeting of the Chapter on "The Relation of Proper Building Construction to Fire Losses."

Cooper Union

Outside speakers addressed most of the members of the Cooper Union Student Chapter during the past year. These included Allen P. Richmond, Jr., Assistant Secretary of the Society; John W. Pickworth, consulting engineer of New York, N.Y.; and William L. Sylvester, designing engineer of the New York City Department of Sanitation. The final meeting of the year took the form of an annual banquet held at the Great Northern Hotel in New York. John Byron Mayer, president of the Chapter, died in July.

UNIVERSITY OF DAYTON

The Society's illustrated lectures formed a valued feature of entertainment at the 1934–1935 meetings of the University of Dayton Student Chapter. An interesting group of student papers was also presented at some of the nine technical meetings. During the year members of the Chapter enjoyed an unusual number of inspection trips, including visits to the American Rolling Mills, the construction projects of the Inland Manufacturing Company, the repair work in progress on the Washington Street bridge, the Dayton sewage disposal plant, and a continuous beam bridge in Franklin, Ohio.

UNIVERSITY OF DELAWARE

The University of Delaware Student Chapter held eight meetings during the school year, with a total attendance of 260. On the list of outside speakers appearing at these sessions were M. S. Knopf, assistant to the chief engineer of the Delaware State Highway Department; B. F. Hastings, of the American Institute of Steel Construction; M. M. Price, manager of the Philadelphia office of the Babcock-Wilcox Company; and Charles E. Grubb, assistant director of the Projects Division of the Federal Emergency Administration of Public Works, Washington, D.C.

DREXEL INSTITUTE

Members of the Drexel Institute Student Chapter had the privilege of hearing a number of interesting outside speakers at their 1934–1935 meetings. These included John A. Bower, of the Philadelphia City Planning Commission; Henry J. Stetina, of the McClintic-Marshall Company; Alfred T. Fleming, of the National Board of Fire Underwriters; W. N. Thomas, executive officer of the Philadelphia Engineer District; and O. E. McMullen, of the Portland Cement Association. On April 17 members of the Chapter attended the Student Chapter conference held at Swarthmore College under the auspices of the Philadelphia Section; on May 15 they were guests of the Section on an inspection trip to points of engineering interest in the Philadelphia district.

DUKE UNIVERSITY

Papers prepared by the students were presented at the meetings of the Duke University Student Chapter held during the past year. These covered a wide range of engineering subjects and proved of considerable interest. In cooperation with the student branch of the American Institute of Electrical Engineers and the Duke Chapter of Mechanical Engineers, members of the Chapter sponsored an engineering show on March 21 and 22. This event took the form of a public display of engineering equipment in operation and student projects and work.

UNIVERSITY OF FLORIDA

During the past school year the University of Florida Student Chapter held eight meetings that were attended by a total of 738 members. Among the speakers at these sessions were C. H. Butler, aerial photographer for the Florida State Road Department; H. D. Mendenhall, consulting engineer; and C. F. Hirschfeld, research director for the Detroit Edison Company. The other activities of the Chapter included participation in the engineers' fair sponsored by the Benton Engineering Society and in Engineers' Day, the annual outing of the entire college. For the fourth consecutive year the Student Chapter carried off the honors on the latter occasion.

GEORGE WASHINGTON UNIVERSITY

A number of interesting speakers addressed the George Washington University Student Chapter during the 1934–1935 school year. Prominent among these were George R. Sanford, of the U. S. Bureau of Reclamation; Philip B. Fleming, deputy administrator of the Public Works Administration; C. R. Whyte, engineer of bridges, District of Columbia; C. A. Hogentogler, of the U. S. Bureau of Public Roads; Roger B. McWhorter, chief engineer of the Federal Power Commission; Donald H. Sawyer, Vice-President of the Society; and Herman Stabler, Director of the Society. Among the social events enjoyed during the year were an engineers' ball and an engineers' banquet. The latter was the culminating feature of a two-day engineers' day program held on April 27 and 28.

HARVARD UNIVERSITY

The 1934–1935 activities of the Harvard University (Harvard Engineering Society) Student Chapter were varied and interesting. Numerous inspection trips were made to points of engineering interest, and ten technical meetings were held. These were addressed by D. E. Moran, F. R. Harris, and G. L. Freeman, consulting engineers of New York, N. Y.; Lazarus White, president of Spencer, White and Prentis; Ole Singstad, chief consulting engineer on tunnels, the Port of New York Authority; Charles M. Spofford, consulting engineer of Boston, Mass.; W. J. D. Reed-Lewis, of the Lawrence Portland Cement Company; Stuart Crandall, of the Crandall Engineering Company; and H. H. Mohr, of the Raymond Concrete Pile Company. Several instructive motion pictures were shown during the year, and members of the Chapter made numerous inspection trips. They were also guests of the Boston Society of Civil Engineers at its annual "Students' Night" held in Boston on November 21.

UNIVERSITY OF ILLINOIS

The University of Illinois Student Chapter reports that, during the 1934–1935 school year, it had a membership of 198, or 72.9 per cent of those eligible. The largest meeting of the year, which was attended by 2,200 persons, featured motion pictures of Boulder Dam. These were shown by J. L. Savage, designing engineer in the Denver Office of the U. S. Reclamation Service. The Chapter was in charge of the civil engineering part of the annual Illinois student engineering exhibit, which included models of bridges and street intersections, and a large surveying display. The central feature of the latter was a full-size triangulation tower constructed by the students. In the spring the Chapter sponsored a three-day inspection trip to visit engineering projects in Chicago and the vicinity.

IOWA STATE COLLEGE

Among the outside activities sponsored by the Iowa State College Student Chapter during the past school year was the arrangement of the civil engineering program for "Veishea," a three-day exhibition held each spring to publicize the college and give an idea of the work of the various departments. Exhibits were designed by the students to portray the work of the civil engineer in the varied fields of the profession. One very practicable model on display was of a proposed grade-separation project devised by highway students for the most dangerous intersection in Ames. There were 12 meetings held during the year, and these attracted a total attendance of 840. The showing of motion pictures of various important engineering projects was the nucleus of entertainment at these sessions.

JOHNS HOPKINS UNIVERSITY

Faculty members and students cooperated to make the 1934–1935 meetings of the Johns Hopkins University Student Chapter instructive and stimulating. Two outside speakers were also heard on subjects of current engineering interest, and illustrated lectures loaned by the Society were enjoyed on several occasions. On May 7, the Chapter held a joint meeting with the Maryland Section of the Society at the Engineers' Club in Baltimore, the students providing the program for the occasion.

UNIVERSITY OF KANSAS

Papers prepared by students were presented at the meetings of the University of Kansas Student Chapter held during the past year. There were nine meetings and a total attendance of 273. Engineers' day held in the spring aroused a great deal of enthusiasm. Field events were enjoyed on this occasion, and a banquet was held in the evening. In May, senior members of the Chapter visited points of engineering interest in Kansas City, Mo., and Independence, Mo. Inspection was also made of both steel and concrete bridges in and around Kansas City.

KANSAS STATE COLLEGE

A total of 751 attended the 13 meetings held by the Kansas State College Student Chapter during the past year. The program of entertainment at these sessions included talks by students, members of the faculty, and outside speakers. Among the latter were J. B. Spiegel, district engineer of the U. S. Geological Survey at Topeka, Kans.; V. L. Pierce, assistant engineer of the Kansas

State Highway Commission; Henry Earle Riggs, Vice-President of the Society and Honorary Professor of Civil Engineering at the University of Michigan; N. T. Veatch, consulting engineer of Kansas City, Mo.; and F. W. Epps and Frank Virr, of the Kansas State Highway Commission. On one occasion a moving picture on arc welding was furnished by the General Electric Company, and a smoker was held on the evening of May 2 at the Community House.

Oklahoma Agricultural and Mechanical College

Alternate technical and social meetings were held by the Oklahoma Agricultural and Mechanical College Student Chapter during the 1934–1935 school year. The technical programs included the showing of slides or motion pictures, and the presentation of short papers by student members who had had practical experience in some phase of civil engineering, while the social meetings were characterized by some form of entertainment and refreshments. The Chapter played an important part in the biennial engineering show held in the spring under the sponsorship of the School of Engineering. Some of the outstanding exhibits of the occasion were displayed by the Chapter.

Members of Oklahoma Agricultural and Mechanical College Student Chapter

University of Kentucky

Illustrated lectures supplied by the Society furnished the nucleus of entertainment at meetings of the University of Kentucky Student Chapter held during the recently completed school year. Motion pictures of various engineering projects, shown through the courtesy of various commercial firms, were also enjoyed. In November members of the Chapter visited Norris Dam and also attended the joint meeting of the Mid-South and Tennessee Valley Sections held in Knoxville, Tenn.

Lafayette College

Students, members of the faculty, and outside speakers cooperated to make the past year interesting and instructive for members of the Lafayette College Student Chapter. There were nine meetings, with a total attendance of 168. The high light of the year was the annual banquet held at the Clinton House in Clinton, N.J., on May 10, with E. L. Durkee, assistant engineer of the McClintic-Marshall Corporation, as principal speaker. Mr. Durkee gave an illustrated talk on the Golden Gate and San Francisco–Oakland Bay bridges, on the construction of which he has recently been engaged by McClintic-Marshall.

Lehigh University

Several interesting outside speakers addressed the Lehigh University Student Chapter during the 1934–1935 school year. Among these were G. A. Rahn, research engineer of the Pennsylvania Department of Highways; Robert L. Fox, city engineer of Bethlehem, Pa.; E. L. Durkee, assistant engineer of the McClintic-Marshall Corporation; and Thaddeus Merriman, consulting engineer of New York, N.Y. In October the senior members of the Chapter made the customary fall trip to the McClintic-Marshall plant at Pottstown, Pa., and in November they spent three days in New York City, inspecting different construction projects.

Lewis Institute

The 1934–1935 report of the Lewis Institute Student Chapter shows 100 per cent enrolment of those eligible for membership. The Chapter was instrumental in sponsoring the annual engineering day exhibit, which attracted over a thousand visitors. Through the cooperation of various commercial firms an interesting and valuable display was arranged. On the list of outside speakers were N. E. Lant, bridge engineer of the Louisiana State Highway Commission, and Walter E. Jessup, Field Secretary of the Society.

University of Maine

Six meetings, with a total attendance of 242, were held by the University of Maine Student Chapter during the past year. On one occasion a motion picture depicting work on Boulder Dam was shown through the courtesy of the Babcock-Wilcox Company, and on May 17 an inspection trip was made to the Rockport (Me.) lime kilns and the Lawrence portland cement plant in Thomaston, Me.

Tulane University

The Tulane University Student Chapter reports that its 1934–1935 registration was 19 members, or 69 per cent of those eligible. During the year there were 17 meetings, with ten outside speakers. The Chapter sponsored five inspection trips: to the new bridge across the Mississippi at New Orleans, to a creosote works and a Standard Oil Plant, to the Bonnet Carré spillway site, and to the "Seatrain" (a ship which carries boxcars).

Manhattan College

Illustrated lectures loaned by the Society were in great demand for the 1934–1935 meetings of the Manhattan College Student Chapter. Various interesting outside speakers appeared before other sessions, the list including William Dudley, of the Western Union Telegraph Company; J. K. Finch, Renwick Professor of Civil Engineering at Columbia University; Edward Buckley, of the Hemphill Diesel Engine Schools; and Allen P. Richmond, Jr., assistant to the Secretary of the Society. In all, there were 14 meetings, with a total attendance of 1,900.

Marquette University

Members of the Marquette University Student Chapter played an active part in providing the programs for the technical meetings held during the past year. Illustrated Society lectures were enjoyed at some sessions, and on one occasion a motion picture was shown through the courtesy of the Chain Belt Company.

Massachusetts Institute of Technology

The Massachusetts Institute of Technology Student Chapter was entertained by the Boston Society of Civil Engineers at the beginning of the past school year, the feature of the occasion being an inspection trip to view the new bridges spanning the Cape Cod Canal. On October 24 members of the Chapter attended the student dinner given by the Boston Society of Civil Engineers. At other meetings held during the year illustrated Society lectures were enjoyed, and on several occasions outside speakers were heard. Among the latter were W. J. D. Reed-Lewis, of the Lawrence Portland Cement Company, and Prevost Hubbard, chemical engineer of the Asphalt Institute.

Michigan College of Mining and Technology

During the 1934–1935 school year the Michigan College of Mining and Technology Student Chapter held seven meetings, which were attended by 236. The Chapter won first prize for its engineering float in the winter carnival parade, and in the spring it participated actively in an engineering show held by the college.

Michigan State College

A large number of interesting and instructive papers were presented by the students at the 1934–1935 meetings of the Michigan State College Student College, some of the meetings taking the form of a senior seminar. On May 14 a joint meeting with the Detroit Section of the Society was held in the Union Memorial Building. There was a total attendance of 80, many of whom came from Detroit for the occasion. A thought-provoking talk on the topic, "This Disturbed World," was given by Edward H. Ryder, dean of the College of Liberal Arts. A brief discussion of Society affairs was then presented by Walter E. Jessup, Field Secretary of the Society. There were 26 meetings held during the year, with a total attendance of 600.

ITEMS OF INTEREST

Engineering Events in Brief

CIVIL ENGINEERING for November

AMONG the noteworthy articles scheduled for the November issue is one by Herbert J. Knopel, consulting engineer, on "Central-Mixed Concrete in Philadelphia and Environs." As a result of the modern method of specifying concrete by strength requirements, the past decade has witnessed the springing up at many points of central plants equipped to furnish properly proportioned ready-mixed concrete directly on the job. An abundance of natural sand and gravel obtainable in Philadelphia and vicinity has led to the development in that region of several large organizations which maintain efficient technical operating forces and turn out an excellent product. But it may also be stated that wherever such plants exist, throughout the country, their facilities enable them to furnish concrete of a quality that can seldom be equaled by the locally mixed product.

Construction of the first section of the Tokyo underground railway will form the subject of an interesting paper by T. Totake, consulting engineer, to appear either in the November number or in another early issue. In 1923, as preparations for construction were going forward, the disastrous Tokyo earthquake and fire put an effective stop to them. The destruction gave opportunity, however, to straighten and widen some streets along the route, to the great advantage of the subway work, which was resumed in 1925.

A knowledge of contracts of suretyship and guarantee is as useful to the engineer who specifies or administers construction work as to the contractor who undertakes to do the work. A paper by Herbert M. Knight, M. Am. Soc. C.E., engineer for a well-known casualty company, dealing with the respective rights, duties, and obligations of the three parties involved in bonding contracts, will appear in the November issue.

Supplementing a paper on the investigation of the torsional rigidity of standard structural sections, which appeared in the April 1935 issue of PROCEEDINGS, Bruce Johnston, Jun. Am. Soc. C.E., of the Columbia University faculty, will describe in the November number the procedure used in determining this property. The apparatus used by Mr. Johnston, in collaboration with Prof. Inge Lyse of Lehigh University, provided a means for accurately measuring the volume and contours of soap bubbles blown through apertures of the size and shape of various structural sections. Then the total volume of the displaced bubble, as demonstrated by Prandtl in 1903, is proportional to the torsional rigidity of the section.

On account of space requirements it has been necessary to postpone publication of the interesting article on "A Timber Lift-Span Bridge," by H. F. Whitlock, Assoc. M. Am. Soc. C.E., until the November number.

Entrance to Field Building

ON THE FRONTISPIECE, or page of special interest, in this issue appears a photograph of one of the entrances to the Field Building in Chicago. Here the photographer has succeeded in recording an unusual lighting effect which at first glance appears artificial. It is produced, however, by natural means—in this case by sunlight falling nearly parallel to the face of the building and accentuating the vertical lines.

This effect harmonizes with the so-called vertical skyscraper design, which emphasizes the tall, slender proportions of the structure as a whole. A general description of the Field Building is presented in one of the articles in this issue.

Wisconsin Registration Law Broadened

ON SEPTEMBER 5, when Governor La Follette signed an act of amendment, the Wisconsin registration act was broadened to include all branches of engineering. The law as amended provides for the registration of architects and of professional engineers. The bill passed the assembly by a 75 to 10 vote, the senate concurring 29 to 0.

The new law does not require that professional engineers be classified according to fields of activity. The existing board of examiners was not disturbed and will continue to function as the new board, the members holding office until their terms expire, as provided under the old act. The new board consists of nine members, including the state architect, the state engineer, the dean of the college of engineering of the state university, three architects, and three professional engineers.

The practice of professional engineering is defined in the act as "any professional service, requiring the application of engineering principles and data, wherein the public welfare or the safeguarding of life, health or property is concerned and involved, such as consultation, investigation, evaluation, planning, design, or responsible supervision of construction, alteration, or operation, in connection with any public or private utilities, structures, bridges, industrial plants, buildings, machines, equipment, processes, works, and the structural members of other than industrial buildings."

This information has been furnished by L. F. Van Hagan, Assoc. M. Am. Soc. C.E., Professor of Railway Engineering, University of Wisconsin, a member of the Wisconsin State Board of Examiners of Architects and Engineers.

New England Earthquake of 1755

HOW WERE earthquakes recorded before the days of the seismograph? An earthquake of some intensity occurred in New England on November 18, 1755, about a century before the first seismometer worthy of the name was invented. This earthquake was described in detail by John Winthrop, Hollistan Professor of Mathematics and Philosophy at Cambridge, in an address made in the chapel of Harvard College eight days later. Students of seismography will look in vain in his account for such terms as maximum horizontal acceleration and epicenter, but Professor Winthrop certainly used the facilities which were at his disposal in a logical manner. Excerpts from his account follow:

"God be thanked, all earthquakes are not formidable in so high a degree. Those of New England, in particular, which have indeed greatly and justly alarm'd the inhabitants, have never destroyed them. For tho' this country, we know, has been visited with earthquakes from its first settlement by the English, yet, so far as my information reaches, not a single life has been lost by any of them; and perhaps never so much damage done to our buildings as by the last great shock. . . .

"The duration of the great shock was longer than has been usually observed. If my memory fails me not, even those earthquakes, which have brought on the most amazing catastrophies, have commonly done their execution in one or two minutes; whereas this shock with us lasted at least four; taking in the whole of the time, from the first agitation of the earth, till it has become perfectly quiet; though the violence of the shock did not last above half so long. This I am assured of, partly from the observations of some Gentlemen, who were up, and looked on their watches, when it began and ended; and partly from my own, which were as follows. The preceding noon, I had adjusted both my clock and watch, by a meridian line; and the following noon I found that the watch had kept time exactly. Being awaked by the earthquake, I lay till the violence of it seemed to be over, for the second time; for it had a little abated before, as if it were going off, and then instantly began again with redoubled fury. Till then I forebore to rise, because the agitation was so vehement, that I concluded it would be very difficult, if not impracticable, to go from the bed to the chimney, without being thrown down; and therefore thought it best not to attempt it. The space of time, in which I lay awake, I cannot think to be much, if anything, less than 2′. This was the conjecture I formed at that time; though it being but conjecture, I would not lay very great stress upon it, were it not supported by concurring observations. On the second abatement I rose, and lighting a candle, looked on my watch, and found it to be 15′ after 4. The shock then was not quite over, but the windows continued rattling for about a minute longer, as near as I can remember; for the shock went off very gradually. As soon as I had looked on the watch, I went directly to the clock, which was in another chamber, that I might see whether that agreed with the watch; and found that it was stop'd at 4 hours 11′ 35″. It's stopping, however, was not, immediately, owing to the violence of the shock, though several clocks, and watches too, at Boston are said to have been stop'd by it; but to the following accident. Having some time before used a pretty long glass tube, in a particular experiment, I had shut it up in the clock-case for security; and this tube, being overthrown by the earthquake, lodged against the pendulum, and stop'd it's motion. By this accident, the beginning of the earthquake, I conceive, is determined with all the exactness that can be desired; for, so far as I can learn, the first shake was violent enough to overset so tall, slender a body, and standing in a position so near a perpendicular, as that tube; and it was impossible for the pendulum to make one oscillation, after the tube had struck against it. Now from the time when the clock stop'd, to my looking on the watch, it was about 3′ 1/2; and the jarring was not quite over, till about a minute after this: So that I think I speak within bounds, when I say, that this shock with us lasted at least 4′. In other places, its duration might possibly be different. . . .

"Several accounts of the late earthquake having been already published by different hands, particularly very full and distinct ones by the Rev. Doctors Chauncey and Mayhew; I think it needless for me to add anything farther upon this head, except the following short notes. . . .

"I have received undoubted intelligence from a Gentleman in that neighbourhood, that the report we had of 'a prodigious chasm made in the ground at Newington in New-Hampshire, of 60 rods in length, and 2 feet in breadth,' is a pure fiction; and that it had no other foundation that this (if this indeed can be called a foundation for such a story) that a stone fence in that town, standing upon a sandy ground, was shaken down by the earthquake; and the force of the falling stones, having beat up the sand on each side, made some appearance of an hollow in the middle."

The preceding excerpts, taken from Professor Winthrop's book, *A Lecture on Earthquakes: Read in the Chapel at Harvard-College in Cambridge, N.E., November 26, 1755*, were furnished by Charles M. Spofford, M. Am. Soc. C.E.

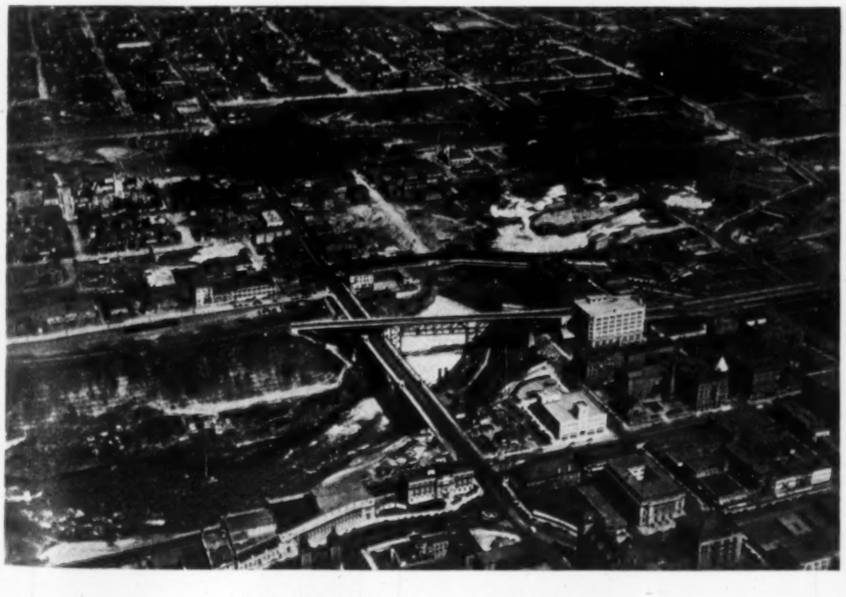
An Unusual Concentration of Engineering Structures in Spokane

Many kinds of engineers have been called upon to answer the challenge of the river which bisects the downtown district of Spokane, Wash. They have spanned it with highway and railroad bridges and harnessed it to develop power for the community. The result has been an interesting and unusual conjunction of power and transportation facilities.

The first bridge in the foreground is the open-spandrel concrete arch on Monroe Street, one of the principal north-south thoroughfares of the city. Crossing over Monroe, in the foreground, almost at right angles, the Chicago, Milwaukee, St. Paul, and Pacific Railroad is carried across the river on the deck-truss structure silhouetted against the lower rapids. Nearly parallel to the Milwaukee and adjacent to it are the tracks of the Great Northern Railroad. Upstream and to the right can be seen the through-truss vehicular span at Howard Street, crossing the river by way of Havermale Island.

The falls at Howard Street and those above Monroe Street are usually termed the Upper and Lower Falls of the Spokane River. Underneath the Monroe Street Bridge and to its right are the power house and penstocks for the Lower Falls power development of the Washington Water Power Company, and immediately below the island is the power house for the Upper Falls development.

It is interesting to think while looking at this modern scene that less than a century ago Havermale Island was the refuge of white settlers during times of trouble with the Indians.



An Aerial View of Spokane, Wash.

In the Small Compass of This One Picture Is Visible the Handiwork of Many Branches of the Engineering Profession. Black Areas in the Photograph Are the Result of Cloud Shadows

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Formulation of the Law of Falling Bodies

A Historical Account of the Origin of an Important Relationship in Dynamics

One is sometimes surprised to discover that many years of study lie behind something one has come through familiarity to take more or less for granted. The law of falling bodies, applied daily by the hydraulic engineer to his computations of flow, is a case in point. For so many years has $v = \sqrt{2gh}$ served as the point of departure for hydraulic texts, that most of us have come to consider it almost as an axiom—a beginning of beginnings. Yet behind it stand two hundred and fifty years of work, and a preceding two hundred and fifty years of speculation.

The late Clemens Herschel, Honorary Member and Past-President of the Society, tells the story in the explanatory chapters of his *Frontinus and the Water Supply of the City of Rome* (published in 1899). He takes us back first to Roger Bacon, that voice crying in the wilderness of the thirteenth century and making ready the way for experimental science. (Strangely enough, Lord Francis Bacon is frequently credited as being the apostle of experiment, although he did not live until 350 years later.) It was Roger Bacon who, in urging the importance of research in determining natural law, laid the groundwork for the development of the formula; for as Herschel says, "No amount of speculation alone, or of peripatetic philosophy, would have produced it. To do that, the work of centuries of earnest men, not too proud to dip their hands into bowls of water, and to *experiment* in hydraulics, the while they were wearing mechanics' overalls, so to speak, was absolutely necessary."

Some two hundred years later came da Vinci, whose skill as teacher, experimenter, writer, and engineer has long been too deeply obscured in the brilliance of his painting and sculpture. Da Vinci's contribution to our formula was in his investigation of the law of falling bodies.

For this research he rigged up an interesting device consisting of two long boards hinged together like the leaves of a book. On the inside they were smeared with tar or wax, and a string latch served to close them suddenly. A small tube filled with shot having about the same diameter as the tube completed the apparatus. In performing the experiment, the tube was held vertically in and over the angle of the wooden book, which was itself set up vertically. The shot were then allowed to drop out, and the latch was pulled, catching them between the leaves and impressing their location on the wax covering.

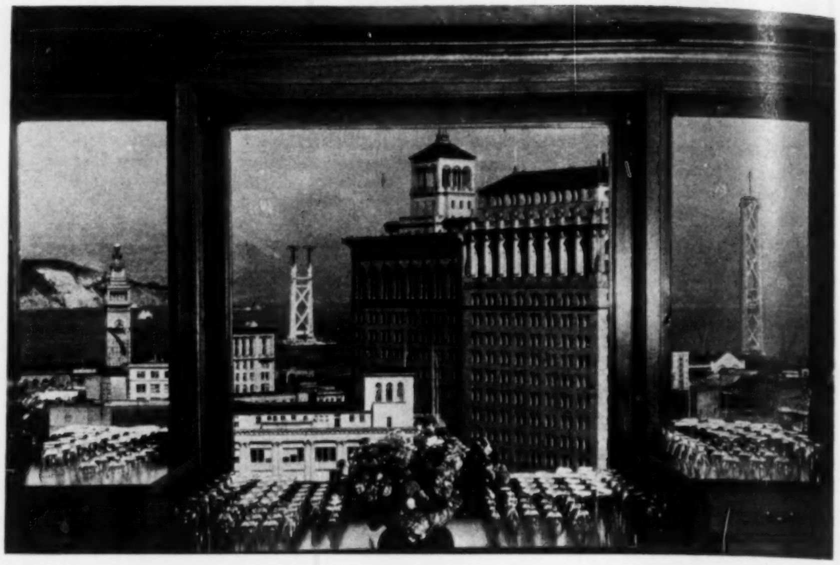
Almost another century passed and Galileo dropped cannon balls from a leaning tower. The first statement of the law of falling bodies was now not far away. But "Galileo had no proper means for measuring time, no clocks or watches," writes Herschel. "Instead, he used a large bowl of water, having a small orifice at the bottom, and compared times by the weight of water discharging during these times; using his finger to start and stop the flow of water out of the bowl."

It was probably from this very "clock" that Castelli, pupil of Galileo, got his idea for an experimental demonstration of the laws of efflux in general. Castelli was the first to show that the quantity of efflux in a given time was a function of the depth of water in the container—that is, of the head. He made it, however, a first-power function.

The radical sign was not long in making its appearance; Torricelli adds it only two years after Galileo's death.

"But this still furnished no numerical value for the velocity of efflux," continues Herschel. "Still another, and still other great men, had to devote their lives to this cause; thirty more years had to pass by, till Huygens (1629–1695), the inventor of pendulum clocks, first found the numerical value of the acceleration of gravity, commonly represented by the letter g, in 1673; and sixty-five more years had to elapse, until the genius of the two Bernouillis, father and son, in 1738, or two hundred and fifty years after Leonardo da Vinci, finally laid the foundation of modern determinate hydraulics, by writing the equation of $v = \sqrt{2gh}$, every letter and character of which may be considered the contribution of, and a tribute to, the skill and perseverance of one or more of the many great men that have been named."

The "beginnings" here were certainly far beyond the superficially apparent ones, and suggest that there may be a tale well worth the telling back of many another common engineering formula.



AN ENGINEERING OUTLOOK

The San Francisco–Oakland Bay Bridge Takes Form Outside the Windows of the San Francisco Engineers' Club

Engineers Watch Bridge Progress at Their Leisure

In the Engineers' Club of San Francisco, members of the San Francisco Section and their guests have a unique vantage point for watching progress in the construction of the San Francisco–Oakland Bay Bridge.

In the accompanying photograph Yerba Buena Island is seen through the left window. The excavation for the island anchorage of the suspension spans and the approach cut for the tunnel through the island is visible. The tower of the Ferry Building appears here also. Through the middle window, one of the towers is seen being erected by two hammer-head cranes. Through the right-hand window appears another tower which has risen to full height.

As explained in articles in CIVIL ENGINEERING for April 1934 and December 1934, this great bridge spans the West Channel—from Rincon Hill in San Francisco to Yerba Buena Island—with a double suspension span having an overall length of 2 miles, and the East Channel—from Yerba Buena Island to the Oakland shore—with a 1,400-ft cantilever span, a series of 23 deck and truss spans, and a long rock and sand fill. On Yerba Buena Island the roadway passes through a tunnel 540 ft long, having a width of $65\ ^1/_2$ ft and a height of 51 ft. This is said to be the largest vehicular tunnel in cross sectional dimensions yet built. The overall length of the bridge is $8\ ^1/_4$ miles.

On September 1, 1935, cables for the west suspension span were more than half spun and the catwalks for the east suspension span were ready for cable spinning. All steel is erected in the East Channel crossing except that for one cantilever anchor arm and the suspended span. In the tunnel the lining is nearly all in place and steam shovels are attacking the core. Traffic is expected to be admitted to the bridge sometime in 1937.

The photograph was furnished through the courtesy of H. J. Brunnier, M. Am. Soc. C.E., a member of the Board of Consulting Engineers of the San Francisco–Oakland Bay Bridge.

Western Society of Engineers Elects Officers

AT THE MEETING of the board of direction of the Western Society of Engineers on August 27, 1935, Frank F. Fowle was elected president and Leigh S. Keith secretary. Edgar S. Nethercut, M. Am. Soc. C.E., who has served the Western Society continuously as secretary and director for 18 years, was elected secretary emeritus.

Mr. Nethercut's election was in recognition of his outstanding service to the membership of the society. The action was taken after he had announced his wish to retire from the position of secretary, in order to devote his time to travel and historical research in the field of engineering.

NEWS OF ENGINEERS

From Correspondence and Society Files

JACOB E. WARNOCK has been promoted from the position of associate engineer in the U. S. Bureau of Reclamation to that of hydraulic research engineer in the same organization. His headquarters have been transferred from Fort Collins, Colo., to Denver, Colo.

RALPH H. BURKE, formerly chief engineer of the Chicago Park District, is now deputy administrator of the Works Progress Administration in Illinois, with offices in Chicago, Ill.

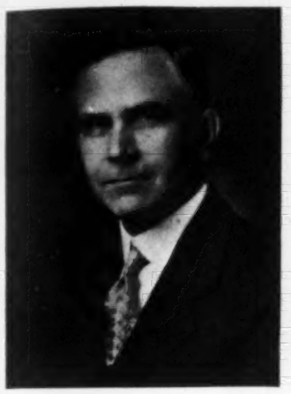
FRANCISCO PONS, consulting engineer of New York, N.Y., was recently appointed director of the New York office of the Department of Agriculture and Commerce of the Government of Puerto Rico.

JAMES R. FITZPATRICK, formerly vice-president in charge of sales of the Haskelite Manufacturing Corporation, is now director of the Technical Division of the Algoma Plywood and Veneer Company, with offices in Chicago, Ill.

Robert W. Kramer was recently appointed an assistant engineer in the Ohio State Highway Department, with offices in Columbus, Ohio.

Raymond A. Pease, formerly camp superintendent and chief of survey party, Emergency Conservation Work, Minot, N.D., is now resident engineer inspector for the PWA, with headquarters in Fargo, N.D.

Clement C. Williams has been elected to the presidency of Lehigh University, Bethlehem, Pa., and will assume this office on October 1. For a number of years he has been dean of the College of Engineering of the University of Iowa and for the past year president of the Society for the Promotion of Engineering Education.



Clement C. Williams

W. P. Darwin has severed his connection with the Engineering Division of the U. S. Bureau of Public Roads in Washington, D.C., to become engineer examiner for the PWA in Nashville, Tenn.

Charles N. Strong is now connected with the Phosphate Mining Company of Nichols, Fla. He was formerly a surveyor for the U. S. Coast and Geodetic Survey in Palatka, Fla.

Victor J. Mill, of Andover, Mass., has purchased the Lawrence Machine and Pump Company, of Lawrence, Mass., and will continue to operate it under the name of the Lawrence Machine and Pump Corporation.

Arthur J. Trapp, assistant construction engineer in the U. S. Treasury Department, has been transferred from New York, N.Y., to Washington, D.C., where he will assist in the construction of the new Department of Interior Building.

Edmund F. Preece is now engineer in charge of the Engineering Section of the State Park Division of the National Park Service and acting technical administrator of state parks for the E. C. W., with headquarters in Washington, D.C.

T. J. Westerberg has resigned his position as instructor in the Morgan Park Junior College, in Chicago, Ill., to become an engineer for the Chicago, Milwaukee, St. Paul Railroad, with headquarters in the same city.

W. W. Studdert has resigned as surveyor and chief of party for the U. S. Coast and Geodetic Survey in order to accept the position of assistant engineer in the U. S. Engineer Office at Elmira, N.Y., on a flood-control project.

Russell Alger Hall has been promoted from the position of Associate Professor of Civil Engineering at Union College to that of co-chairman of the Division of Engineering, in charge of civil engineering at the college.

Arthur L. Pauls has joined the staff of the Tennessee Valley Authority and is at work on the Pickwick Landing Dam at Corinth, Miss. He was previously in the U. S. Engineers Office at Zanesville, Ohio.

Walter G. Will has been promoted from the position of assistant superintendent of the 11th Lighthouse District, Detroit, Mich., to that of superintendent of lighthouses in charge of the 15th Lighthouse District, St. Louis, Mo.

Chamras Chayabongse is now in Bangkok, Siam, where he is with the Division of Water Supply of the Department of Public and Municipal Works.

Samuel T. Carpenter, formerly an assistant in the Department of Civil Engineering at Ohio State University, is now an instructor in the Division of Engineering at Swarthmore College, Swarthmore, Pa.

Frank E. Winsor was the recipient of honorary membership in the New England Water Works Association, at its meeting on September 17 in Providence, R.I. He has been chief engineer on the new Scituate works for the Providence water supply and is now acting in a similar capacity for the Metropolitan District Water Supply Commission of Boston, Mass., in developing the Ware and Swift River sources. He was president of the association for the 1926–1927 term.

Frank E. Winsor

Frank J. McCormick, who was formerly a research fellow in the Department of Mathematics at Iowa State College, has now taken a position as draftsman in the Department of Bridge Design of the Iowa Highway Commission. His headquarters are in Ames, Iowa.

Changes in Membership Grades

Additions, Transfers, Reinstatements, Deaths, and Resignations

From August 10 to September 9, 1935, Inclusive

Additions to Membership

Bates, William Lewis (Jun. '35), Guilford, Me.

Bondurant, John Parnell (Assoc. M. '35), Senior Project Asst., National Park Service, Hill St., Athens, Ga.

Brown, George Rufus (Assoc. M. '35), Vice-Pres. in Chg., Brown & Root, Inc., Box 3, Houston, Tex.

Brown, Matthew Raymond (Jun. '35), With Park Dept. (Res., 3070 Roberts Ave.), New York, N.Y.

Browning, Carey Roy (Assoc. M. '35), Cons. Engr., Rancho Santa Nargarita, Box 525, Tustin, Calif.

Burroughs, Billy Bob (Jun. '34), Linden, Tex.

Cadilla Ginorio, Ulises (Jun. '35), Senior Insp., U. S. Engr. Office, War Dept., San Juan, Puerto Rico.

Carrier, Charles Robert (Assoc. M. '35), Chf. Superv. Insp., Dept. of Public Works (Res., 4555 Main St.), Kansas City, Mo.

Childs, Benjamin O'Connor (M. '35), Drainage Engr., U. S. Dept. of Agriculture, Bureau of Agri. Eng., Box 787, Houma, La.

Ciufi, Harry Aurelius (Assoc. M. '35), Res. Engr. Insp., Inspection Div., PWA; 784 Thirty-Sixth Ave., San Francisco, Calif.

Clare, Horacio Emilio, Jr. (Jun. '35), With Grebien & Martinz, Inc., Box 5043, Cristobal, Canal Zone.

Clarke, Gilmore David (M. '35), Cons. Landscape Archt.; Landscape Archt., Westchester County Park Comm., Room 532, County Office Bldg., White Plains (Res., 7 Benedict Pl., Pelham), N.Y.

Cortright, Harry Miller (Jun. '35), Junior Hydr. Engr., U. S. Govt., TVA, 208 Arcade Bldg., Asheville, N.C.

Crocker, Fred Wilbur (M. '35), 4205 South West Front Ave., Portland, Ore.

Cushman, Robert Ellis (Assoc. M. '35), Sales Engr., Detailer and Consultant, Chas. R. McCormick Lumber Co. (Res., 2827 North East Bryce St.), Portland, Ore.

de Vries, Karl (M. '35), Designer, Bethlehem Steel Co. and McClintic-Marshall Corporation (Res., 629 Fifteenth Ave.), Bethlehem, Pa.

Downs, Edward Richardson (Jun. '35), 3626 Norledge Pl., Kansas City, Mo.

Foley, Edward William (M. '35), Pres., Faircroft Eng. Corporation, 16 Court St., Brooklyn, N.Y.

Gedo, Jules Duci (M. '35), 49 West 94th St., New York, N.Y.

Haner, Norman Winfield (Assoc. M. '35), Asst. Engr., U. S. Engrs., War Dept. (Res., 2816 North East 66th Ave.), Portland, Ore.

Harris, Albert Bullen (Jun. '35), Junior Hydr. Engr., Water Resources Branch, U. S. Geological Survey, Dept. of Interior, Box 1311, Tucson, Ariz.

Hickson, Robert Edward (M. '35), Senior Engr., U. S. Engr. Dept., 319 Custom House, Portland, Ore.

Hiltner, Walter Frederick (Jun. '34), Care, South American Development Co., Apartado 655, Guayaquil, Ecuador (Res., 4215 East 33d St., Seattle, Wash.).

Koo, Tsu-Yuan (Jun. '35), Care, San. Eng. Dept., National Health Administration, Nanking, China.

Hoskinson, Carl McKee (M. '35), Chf. Engr., Div. of Water and Sewers, City of Sacramento, Eng. Dept. (Res., 1140 Forty-Third St.), Sacramento, Calif.

Hudson, William Norton (Assoc. M. '35), 87 Mariner St., Apartment 39, Buffalo, N.Y.

Lenehan, George Warden (Jun. '35), Insp. and Junior Engr., U. S. Waterways Experiment Station (Res., Y.M.C.A.), Vicksburg, Miss.

Lindso, Gunvald (Assoc. M. '35), With McClintic-Marshall Corporation, Steelton (Res., 2017 Chestnut St., Harrisburg), Pa.

Matson, Rosser Holloway (Assoc. M. '35), Water Resources Coordinator, State Planning Board, Elm Lodge, Ames, Iowa.

Muñoz, Carlos Alberto (Jun. '35), Insp., U. S. Engr. Office, Puerto Rico Dist., 1 Continuación Condado St., Santurce, Puerto Rico.

Nanry, John James (M. '35), Engr.-Examiner, with State Engr., PWA, New York, N.Y.

Nowaczek, Frank Huxley (Assoc. M. '35), Asst. Engr., Governor's Comm. on Unemployment Relief; 76 Himrod St., Brooklyn, N.Y.

Oberg, Stanford Wilbur (M. '35), Chf. Engr., Humble Oil & Refining Co., Box 2180, Houston, Tex.

Ord, Melvin James (Jun. '35), Gauge Reader, U. S. Waterways Experiment Station (Res., 1620 Vick St.), Vicksburg, Miss.

Padilla, Gustavo Eugenio (Assoc. M. '34), Res. Engr., Dept. of The Interior, Govt. of Puerto Rico, Guayama, Puerto Rico.

Polisson, Paul Angel (Jun. '35), City Engr., City Hall, Gloucester, Mass.

Ponder, Hubert Lawson (Jun. '35), Engr. and Draftsman, U. S. ECW, for Florida Forest Service, Box 24, Foley, Fla.

Pratt, Alma (Jun. '35), With SCS, Box 575, Price, Utah.

Randall, Carey Allen (Jun. '35), 2d Lieut., U.S.M.C., Basic School, Navy Yard, Philadelphia, Pa.

Ream, John Milton (Assoc. M. '35), Field Engr., The Carmichael Constr. Co. (Res., 82 Dick Ave.), Akron, Ohio.

Rogers, John Willard (Jun. '35), 119 Third Drive, N.W., New Philadelphia, Ohio.

Sharp, James Francis (Jun. '35), With TVA, 2207 Dixie Pl., Nashville, Tenn.

Soucek, Edward (Jun. '35), Asst. Engr., State Planning Board, 727 North Lucas St., Iowa City, Iowa.

Spielvogel, Siegfried Werner (M. '35), Asst. Engr., Brooklyn Edison Co., 380 Pearl St. (Res., 70 Remsen St.), Brooklyn, N.Y.

Street, Gustavus Calder, Jr. (M. '35), State Engr. Insp., PWA, for Texas and New Mexico, 905 Elec. Bldg. (Res., Worth Hotel), Fort Worth, Tex.

Ubbink, William John (Assoc. M. '35), County Highway Commr., Ozaukee County (Res., 740 Grand Ave.), Port Washington, Wis.

Vockroth, John Henry (Jun. '35), Archt. and Engr. (Mastriani, Riggi & Vockroth), 412 Mears Bldg., Scranton (Res., 1808 Green Ridge St., Dunmore), Pa.

Vogelgesang, Carl Edgar (Assoc. M. '35), Engr. of Plans, State Highway Comm. (Res., 2921 Ruckle St.), Indianapolis, Ind.

Whitehead, Lindsey Wood (M. '35), Associate Prof. of Civ. Eng. and Staff Asst. in Civ. Eng., Dept. of Grounds and Buildings, Pennsylvania State Coll., State College, Pa.

Wishart, William Thomas (Assoc. M. '35), Designer, Bridge Dept., State Highway Dept., Phoenix Ariz.

Membership Transfers

Bailly, Florent Houlding (Jun. '27; Assoc. M. '35), Chf. Engr., Venezuelan Pantepec Co., Apartado 888, Caracas, Venezuela.

Barker, Carl Leon (Jun. '32; Assoc. M. '35), Asst. Res. Engr. Insp., PWA (Res., 3003 Thirteenth Ave., South, Apartment 4), Birmingham, Ala.

Becker, William Chris Emil (Assoc. M. '21; M. '35), Engr., Bridges and Buildings, City of St. Louis (Res., 4119 San Francisco Ave.), St. Louis, Mo.

Binkley, Thad Christian (Jun. '27; Assoc. M. '35), Supt. Suburban Water Co., San Francisco (Res., 790 Amherst St., Palo Alto), Calif.

Blaney, Harry French (Assoc. M. '22; M. '35), Irrig. Engr., Bureau of Agri. Eng., U. S. Dept. of Agriculture, 600 Federal Bldg., Los Angeles, Calif.

Clemens, George Reginald (Assoc. M. '28; M. '35), Senior Engr., Mississippi River Comm., Vicksburg, Miss.

Coughlin, Robert Emmet (Assoc. M. '29, M. '35), Capt., Corps of Engr., U.S.A., Fort William McKinley, Rizal, Philippine Islands.

Englander, Harry (Assoc. M. '22; M. '35), With Moran & Proctor and H. J. Deutschbein Co., Inc.; 52 Campbell Ave., Williston Park, N.Y.

Losee, James Robert (Assoc. M. '21; M. '35), Civ. Engr. and Surv.; Engr. and Supt. of Water Works and Village Engr., 21 Wildey St., Tarrytown, N.Y.

Olafsen, Reidar (Assoc. M. '32; M. '35), Designing Engr., New Kanawha Power Co., Glen Ferris, W.Va.

Phaneuf, Victor Simeon (Assoc. M. '28; M. '35), Dist. Constr. Officer, 2d CCC Dist., Fort Ethan Allen, Vt.

Proctor, Asa Glisson (Jun. '10; Assoc. M. '15; M. '35), Engr., Yolo County; City Engr., Woodland and Davis; Civ. Engr. (Proctor & Miller), Bank of America Bldg. (Res., Cor. 1st and Cross Sts.), Woodland, Calif.

Ridgway, Herbert (Assoc. M. '20; M. '35), Designing Engr., Am. Bridge Co., 71 Broadway, New York, N.Y.

Roberts, Frederick Carlyle, Jr. (Jun. '31; Assoc. M. '35), State San. Engr., State Board of Health, Phoenix, Ariz.

Roche, Edward Charles (Jun. '30; Assoc. M. '35), Engr., Research Laboratories, Linde Air Products Co., 169 Chandler St., Buffalo (Res., 100 Enola Ave., Kenmore), N.Y.

Schaefer, George Allen (Jun. '23; Assoc. M. '26; M. '35), Supt., Public Works and Head Dept. of Public Works, 255 Main St. (Res., 54 Lawn Ave.), Middletown, Conn.

Schureman, Leslie Robbins (Jun. '28; Assoc. M. '35), Asst. Prof., Civ. Eng., Princeton Univ. (Res., 3 Harris Rd.), Princeton, N.J.

Sherlock, Robert Henry (Assoc. M. '25; M. '35), Prof., Civ. Eng., Univ. of Michigan (Res., 1219 Packard St.), Ann Arbor, Mich.

Toerner, John Osmond Aloysius (Jun. '28; Assoc. M. '35), Constr. Engr., Mfrs. Trust Co. (Res., 623 West 207th St.), New York, N.Y.

van den Berg, Cornelius, Jr. (Jun. '24; Assoc. M. '29; M. '35), Pres., West Virginia Water Service Co., Charleston, W.Va.

White, Clark Leo (Jun. '26; Assoc. M. '35), Engr., McClintic-Marshall Corporation, 3d St. (Res., 1128 Elm St.), Bethlehem, Pa.

Wilmot, James (Jun. '08· Assoc. M. '16; M. '35), Park Director, Borough of Manhattan, Dept. of Parks, City of New York, 79th St. and Riverside Drive, New York (Res., 33 Puritan Drive, Port Chester), N.Y.

TOTAL MEMBERSHIP AS OF SEPTEMBER 9, 1935

Members	5.703
Associate Members	6.031
Corporate Members	11,734
Honorary Members	17
Juniors	2,941
Affiliates	96
Fellows	2
Total	14,790

Reinstatements

Applebaum, Leon Benedict, Jun., reinstated Aug. 20, 1935.

Badgley, Ben Oliver, Assoc. M., reinstated Aug. 9, 1935.

Dollard, John Thorvald, Assoc. M., reinstated Sept. 9, 1935.

Johnson, John Albert, Jun., reinstated Aug. 24, 1935.

McMaster, Alfred Dennis, Jun., reinstated Sept. 6, 1935.

Noack, Arthur, M., reinstated Aug. 12, 1935.

Villa Rivera, Miguel, M., reinstated Aug. 26, 1935.

Resignations

Billings, Harry Clayton, Jun., resigned Sept. 3, 1935.

Gerig, Francis Austin, Assoc. M., resigned Aug. 14, 1935.

Morris, Willard Frank, Jun., resigned Aug. 23, 1935.

Yeatts, Ernest Bailey, Jun., resigned Aug. 9, 1935.

Deaths

Alford, William Valorus. Elected Assoc. M. Nov. 1, 1910; M. Mar. 5, 1928; died Aug. 2, 1935.

Budd, Robert Dunn. Elected M. Oct. 4, 1910; died July 30, 1935.

BUTLER, GEORGE. Elected Assoc. M. Sept. 6, 1910; died April 16, 1935.

CRANE, FRANCIS ELIHU. Elected M. Oct. 1, 1902; died Aug. 13, 1935.

GOODNOUGH, XANTHUS HENRY. Elected Assoc. M. May 6, 1896; M. June 4, 1902; died Aug. 10, 1935.

GOTSHALL, WILLIAM CHARLES. Elected M. May 7, 1902; died Aug. 20, 1935.

KERSHAW, GEORGE BERTRAM DE BETHAM. Elected M. Apr. 2, 1913; died July 30, 1935.

ROSEWATER, WILLIAM MARCUS. Elected Assoc. M. June 5, 1901; died May 25, 1935.

SAMPLE, WILLIAM DWIGHT. Elected Assoc. M. Dec. 1, 1908; died Jan. 5, 1935.

STOUT, OSCAR VAN PELT. Elected M. Apr. 18, 1927; died Aug. 4, 1935.

Applications for Admission or Transfer

Condensed Records to Facilitate Comment of Members to Board of Direction

October 1, 1935 NUMBER 10

The Constitution provides that the Board of Direction shall elect or reject all applicants for admission or for transfer. In order to determine justly the eligibility of each candidate, the Board must depend largely upon the membership for information.

Every member is urged, therefore, to scan carefully the list of candidates published each month in CIVIL ENGINEERING *and to furnish the Board with data which may aid in determining the eligibility of any applicant.*

It is especially urged that a definite recommendation as to the proper grading be given in each case, inasmuch as the grading must be based upon the opinions of those who know the applicant personally as well as upon the nature and extent of his professional experience. Any facts derogatory to the personal character or professional reputation of an applicant should be promptly communicated to the Board.

Communications relating to applicants are considered strictly confidential.

The Board of Direction will not consider the applications herein contained from residents of North America until the expiration of 30 days, and from non-residents of North America until the expiration of 90 days from the date of this list.

MINIMUM REQUIREMENTS FOR ADMISSION

GRADE	GENERAL REQUIREMENT	AGE	LENGTH OF ACTIVE PRACTICE	RESPONSIBLE CHARGE OF WORK
Member	Qualified to design as well as to direct important work	35 years	12 years*	5 years of important work
Associate Member	Qualified to direct work	27 years	8 years*	1 year
Junior	Qualified for sub-professional work	20 years†	4 years*	
Affiliate	Qualified by scientific acquirements or practical experience to cooperate with engineers	35 years	12 years*	5 years of important work
Fellow	Contributor to the permanent funds of the Society			

* Graduation from an engineering school of recognized reputation is equivalent to 4 years of active practice.

† Membership ceases at age of 33 unless transferred to higher grade.

The fact that applicants refer to certain members does not necessarily mean that such members endorse.

FOR ADMISSION

ARMENTO, WILLIAM JOSEPH, New York City. (Age 20.) Rodman, Park Dept. Refers to W. Allan, R. E. Goodwin, F. O. X. McLoughlin, J. C. Rathbun.

BAILIFF, NORMAN LYNN, Kansas City, Mo. (Age 29.) Designer and Detailer, Carter Equipment Co. Refers to G. W. Bradshaw, F. W. Epps, R. B. Houston, W. C. McNown, F. A. Russell, J. M. Waller.

BARRASSO, ANTHONY JOHN, Reading, Pa. (Age 25.) Constr. Foreman, Pennsylvania Dept. of Highways. Refers to C. H. Buckius, E. D. Walker.

BENAS, BENJAMIN, San Francisco, Calif. (Age 36.) San. Eng. Designer, San Francisco Eng. Dept. Refers to J. J. Casey, H. P. Eddy, C. G. Hyde, C. C. Kennedy, L. B. Reynolds, H. A. Van Norman.

BIRNBAUM, HARRY, Mt. Victory, Ky. (Age 33.) Chf. of Party, Cumberland National Forest, U. S. Forest Service, Winchester, Ky. Refers to J. C. Dort, W. J. Howard, J. M. Montz, C. T. Morris, C. E. Sherman.

BISHOP, AVERY ALVIN, Delta, Utah. (Age 22.) Refers to G. D. Clyde, H. H. Hodgeson, O. W. Israelsen, H. R. Kepner, R. B. West, L. M. Winsor.

BLAGG, JOHN DORMAN, Murphy, N.C. (Age 32.) Field Engr. with TVA. Refers to R. E. Frierson, H. J. Kelly, H. P. McKean, N. H. Sayford, G. D. Whitmore, H. A. Wiersema.

BRATSCHI, WILLIAM GEORGE, Santa Fe, N.Mex. (Age 34.) Jun. Engr., New Mexico State Engr.'s Office. Refers to E. L. Barrows, J. H. Bliss, B. Johnson, G. M. Neel, W. H. W. Yeo.

BRAY, OSCAR SIMON, Cold Spring, N.Y. (Age 29.) Project Supt., U. S. Dept. of Interior, National Park Service, SPECW. Refers to A. M. Bouillon, H. D. Loring, H. B. Luther, R. W. Renn, J. E. Root, H. Schneider.

BRENNAN, AMBROSE FRANCIS, Brownville, N.Y. (Age 24.) Refers to L. W. Clark, H. O. Sharp.

BROCKWAY, GEORGE SAMUEL, West Palm Beach, Fla. (Age 39.) Fugate & Brockway; Consultant for Port of Palm Beach Administrative Authority. Refers to J. M. Boyd, J. F. Charlton, W. H. Da Camara, G. B. Davidson, W. C. Disbrow, Jr., P. J. Gray, M. R. Kays, R. Y. Patterson, R. W. Reynolds, C. H. Ruggles, W. T. Wallis, Jr.

BROWN, EDWARD STICKNEY, Jr., Newburyport, Mass. (Age 23.) Refers to F. W. Garran, C. A. Holden.

BROWNELL, WILLIAM FRED, JR., White, Plains, N.Y. (Age 21.) Refers to T. Saville, C. T. Schwarze.

CAHALAN, WILLIAM JAMES, East Orange, N.J. (Age 22.) Refers to H. Grant, H. G. Payrow.

CERNY, PAUL JOSEPH, Lawrence, Kans. (Age 28.) Asst. Engr., Kansas State Board of Health. Refers to E. Boyce, J. J. Hinman, Jr., C. H. Hurd, R. E. Lawrence, R. J. Paulette, F. M. Veatch, E. L. Waterman.

CHAPTON, HERBERT JOSEPH, Glendale, Calif. (Age 29.) Senior Topographical Draftsman, Bureau of Water Works and Supply, City of Los Angeles. Refers to E. A. Bayley, W. W. Hurlbut, J. E. Jones, S. B. S. Nelson, S. L. Parratt, R. R. Proctor, W. W. Wyckoff.

CHISARI, MARIO VINCENT, New York City. (Age 22.) Refers to W. Allan, F. O. X. McLoughlin, J. S. Peck, J. C. Rathbun, W. L. Willig.

COHN, MAURICE LEONARD, New York City. (Age 21.) Refers to A. Haring, T. Saville.

COUTS, ROBERT JAMES, Akron, Ohio. (Age 22.) Engr., City Highway Dept. Refers to F. E. Ayer, E. D. Barstow, M. L. Davis, R. C. Durst.

CUEVAS BUSTAMANTE, SERGIO RAFAEL, Guayama, Puerto Rico. (Age 36.) Constr. Engr., Utilization of Water Resources, Puerto Rico. Refers to M. Font, A. S. Lucchetti-Otero, P. C. Pagan, R. Ramirez, E. F. Rice, W. W. Schlecht, R. M. Snell, E. Totti y Torres, J. Urbino.

CURRAN, HENRY GEORGE, New York City. (Age 20.) Rodman, Dept. of Parks, Bronx. Refers to W. Allan, R. E. Goodwin.

DAHL, LESLIE HOWARD, Brooklyn, N.Y. (Age 22.) Refers to H. R. Codwise, H. P. Hammond, L. F. Rader, E. J. Squire.

DALEY, RUSSELL GRANT, Utica, N.Y. (Age 25.) Draftsman and Designer with Richard S. Cookinham, Prof. Engr., and Village Engr. for several villages. Refers to E. F. Berry, S. D. Sarason.

DAVIS, CHESTER ARTHUR, Alhambra, Calif. (Age 21.) Transitman, Surveying Dept., Pacific Elec. Co., of Los Angeles, Calif. Refers to R. R. Martel, W. W. Michael, F. Thomas.

DAVIS, GRANT LIVINGSTON, Hollis, N.H. (Age 22.) Refers to E. W. Bowler, R. R. Skelton.

DES ROCHERS, RAYMOND GEORGE, Aldenville, Mass. (Age 22.) Refers to A. W. French, J. W. Howe.

DIMOCK, ASA REDMOND, Middle Grove, N.Y. (Age 20.) Refers to L. W. Clark, H. O. Sharp.

DONA, DOMENIC AMERIGO, Los Angeles, Calif. (Age 22.) Clerk, Bank of America. Refers to R. M. Fox, D. M. Wilson.

Douglas, Walter Spalding, Plainfield, N.J. (Age 23.) Refers to W. J. Douglas, A. Haertlein, J. P. Hogan.

Drizen, Aaron, Philadelphia, Pa. (Age 23.) Refers to H. L. Bowman, S. J. Leonard.

Dumble, Charles Skiles, Bakersfield, Calif. (Age 26.) Refers to H. S. Allen, F. Merryfield, C. A. Mockmore.

Elstad, Eivind Glestad, New York City. (Age 33.) Structural Designer, M. W. Kellogg Co., Oil Refinery Contrs. Refers to H. A. Abildso, W. W. Chapin, H. C. Elton, H. F. Kjerulf, R. T. Retz, S. O. Rogde, F. N. Severud.

Elwin, Elmer Hill, Jr., Bismarck, N.Dak. (Age 23.) Draftsman and Rodman, North Dakota FERA Eng. Dept. Refers to R. E. Kennedy, W. E. Smith.

Erskine, James Ancona, West Lafayette, Ind. (Age 23.) Refers to C. A. Ellis, R. B. Wiley.

Fenstermaker, John Ralph, Indianapolis, Ind. (Age 21.) Refers to C. A. Ellis, W. K. Hatt, H. S. Morse.

Fink, William Kenneth, Crows Landing, Calif. (Age 25.) Refers to E. L. Grant, C. Moser, L. B. Reynolds, J. B. Wells.

Fisher, Jack Farrington, Berkeley, Calif. (Age 25.) Jun. Engr., Standard Oil Co., San Francisco, Calif. Refers to B. A. Etcheverry, J. M. Evans, F. S. Foote, C. G. Hyde.

Fitzgibbons, George Patrick, Kew Gardens, N.Y. (Age 21.) Refers to J. J. Costa, A. V. Sheridan.

Flanders, Royal Call, Jr., Montpelier, Vt. (Age 24.) Surveyman, U. S. Engr. Dept. Refers to T. R. Lawson, H. O. Sharp.

Fletcher, Frank, Pawtucket, R.I. (Age 23.) Refers to C. D. Billmyer, J. L. Murray.

Foster, Charles Edwin, Rochester, N.Y. (Age 33.) Jun. Engr., Rochester-Monroe County Emergency Work Bureau. Refers to C. V. Brewster, C. C. Cooman, N. H. Davidson, R. H. Kugler, W. H. Roberts, L. B. Smith, P. F. Stephens.

Frisch, Solomon, Brooklyn, N.Y. (Age 23.) Refers to F. E. Foss, J. Meltzer, G. Morrison, G. Paaswell, J. C. Riedel, J. P. J. Williams.

Gearhart, John Chase, Salem, Ore. (Age 21.) Draftsman, Office of State Engineer. Refers to J. R. Griffith, G. W. Holcomb, R. E. Koon, F. Merryfield, C. A. Mockmore, J. C. Stevens.

Gordon, Richard Thomas, New York City. (Age 28.) Draftsman, Office of Chf. Engr., Board of Estimate and Apportionment, City of New York. Refers to D. W. Coe, C. K. Conard, J. C. Riedel, W. J. Shea, E. J. Squire, A. S. Tuttle.

Gusha, James John, Worcester, Mass. (Age 22.) Draftsman and Transitman, Blackstone Valley Flood Control Project. Refers to A. W. French, J. W. Howe, A. J. Knight, C. F. Meyer.

Hall, Louis Woodrow, New York City. (Age 20.) Refers to T. R. Lawson, H. O. Sharp.

Halprin, Benjamin, Brooklyn, N.Y. (Age 21.) Refers to C. T. Schwarze, D. S. Trowbridge.

Hamlet, Leon Marritt, Minneapolis, Minn. (Age 25.) Jun. Engr., State Highway Dept., Soils Div., Morris, Minn. Refers to F. Bass, A. S. Cutler, O. M. Leland, L. G. Straub.

Hanley, Thomas Joseph, New York City. (Age 21.) Refers to J. J. Costa, A. V. Sheridan.

Hartman, John Paul, Ft. Peck, Mont. (Age 27.) Asst. Engr., U. S. Engr. Office. Refers to A. L. Alin, A. A. Brielmaier, G. Gilboy, T. T. Knappen, C. M. Spofford, N. T. F. Stadtfeld.

Hazera, Elie, San Jose, Costa Rica. (Age 26.) Refers to C. T. Schwarze, D. S. Trowbridge.

Heller, Frederic Albert, Chicago, Ill. (Age 24.) Asst. Engr., Creamery Package Mfg. Co. Refers to L. M. Gram, L. C. Maugh.

Hendricks, James Tilman, Norris, Tenn. (Age 22.) Refers to R. P. Black, F. C. Snow.

Herzberg, Noble William, Albany, N.Y. (Age 29.) Jun. Engr. (Hydr.), U. S. Geological Survey. Refers to A. Boyd, E. F. Chandler, A. W. Harrington, H. Johnson, J. L. Lamson, B. W. Steele.

Heuer, William Fred, Jr., Brooklyn, N. Y. (Age 22.) Refers to J. J. Costa, A. V. Sheridan.

Hnot, Walter Rudolph, New York City. (Age 21.) Refers to A. G. Hayden, C. T. Schwarze.

Hughes, Charles Edouard, Jr., Rockford, Ill. (Age 21.) Refers to H. Cross, J. J. Doland, W. C. Huntington, G. W. Pickels, T. C. Shedd, F. W. Stubbs, Jr.

Hughes, James Edwin, Piedmont, Mo. (Age 22.) Jun. Civ. Engr., U. S. Forest Service, CCC Company, Sam Baker Park. Refers to W. C. McNown, F. A. Russell.

Jennings, George Henry, Marcell, Minn. (Age 29.) Refers to C. L. Allen, C. M. Cade, R. E. Everett, C. A. Miller, N. Van Eenam.

Jensen, Earl Samuel, Salt Lake City, Utah. (Age 23.) Refers to G. D. Clyde, O. W. Israelsen, H. R. Kepner, R. B. West.

Joerns, John O'Brien, Santa Fe, N.Mex., (Age 26.) Refers to E. L. Barrows, J. H. Bliss, B. Johnson, H. C. Neuffer.

Johnstone, William Jarl, Reno, Nev. (Age 28.) Refers to F. L. Bixby, H. P. Boardman.

Keaveny, Felix James, Yonkers, N.Y. (Age 31.) Computer, U. S. Coast and Geodetic Survey. Refers to F. A. Boyle, R. E. Goodwin, F. O. X. McLoughlin, R. L. Pfau, S. Rosenberg.

Kenlon, John Fennell, New York City. (Age 20.) Refers to J. J. Costa, A. V. Sheridan.

Kennedy, Joseph Michael, New York City. (Age 21.) Refers to J. J. Costa, A. V. Sheridan.

Ketchum, Milo Clement, Pasadena, Calif. (Age 22.) Refers to R. R. Martel, F. Thomas.

Klein, Francis Burt, University City, Mo. (Age 21.) Refers to W. W. Horner, E. O. Sweetser.

Kramer, Harold Henry, New York City. (Age 21.) Timekeeper, Thomas Crimmins Contr. Co. Refers to H. E. Breed, A. Haring, T. Saville, C. T. Schwarze, D. S. Trowbridge.

Krusa, Paul Henry, Liberty, N.Y. (Age 22.) Refers to W. J. Douglas, L. J. Johnson.

Lagani, Frank Salvatore, New York City. (Age 21.) Refers to R. E. Goodwin, F. O. X. McLoughlin, J. C. Rathbun.

Lambert, Arthur Victor, New York City. (Age 35.) Engr., Dept. of Purchase, City of New York. Refers to H. R. Codwise, J. W. Daly, H. P. Hammond, J. A. Lenecek, F. B. Nelson, L. F. Rader, E. J. Squire.

Lanzoni, Marco Louis, New York City. (Age 26.) Refers to C. T. Schwarze, D. S. Trowbridge.

Laukaitis, George Edward, Maspeth, N.Y. (Age 22.) Refers to T. Saville, C. T. Schwarze.

Linell, Kenneth Andrew, Worcester, Mass. (Age 22.) Refers to A. W. French, J. W. Howe.

Luce, William Falconer, Ft. Worth, Tex. (Age 20.) Refers to O. V. Adams, L. E. Grinter, J. H. Murdough, H. N. Roberts.

Lundheim, Erling Jacob, Minneapolis, Minn. (Age 23.) Refers to F. Bass, A. S. Cutler.

McArthur, Claire Luvoice, Jr., Shreveport, La. (Age 22.) Asst., Arkansas Natural Gas Co., on seismograph survey. Refers to J. E. Kirkhem, E. R. Stapley.

McCray, Lionel Grant, St. Michaels, Ariz. (Age 25.) Surveyor, U. S. Forest Service, Ft. Defiance, Ariz. Refers to J. H. Dorroh, H. C. Neuffer, R. H. A. Rupkey, A. N. Thompson.

McNeary, William James Lippincott, Philadelphia, Pa. (Age 23.) Refers to H. L. Bowman, S. J. Leonard.

Martin, Earl Howard, Morgantown, W.Va. (Age 27.) Refers to L. V. Carpenter, R. P. Davis, W. S. Downs.

Marxen, Paul Berthold, San Francisco, Calif. (Age 23.) With American Bridge Co. Refers to T. A. Jordan, N. D. Morgan, C. E. Palmer.

Mengerink, Cecil Engbert, Napoleon, Ohio. (Age 21.) Refers to C. A. Ellis, R. B. Wiley.

Michener, John Henry, Jr., Bridgeport, Pa. (Age 22.) Refers to H. L. Bowman, S. J. Leonard.

Miller, Eugene Clair, Glendora, Calif. (Age 22.) Refers to W. W. Michael, F. Thomas.

Molloy, John Joseph, Auburn, Mass. (Age 20.) Instrumentman, Industrial Rehabilitation Div., Blackstone River Valley Project. Refers to A. W. French, J. W. Howe.

Moore, Guy William, Buffalo, N.Y. (Age 25.) Refers to E. P. Lupfer, H. O. Sharp.

Moors, August Joseph, Philadelphia, Pa. (Age 23.) Refers to H. L. Bowman, S. J. Leonard.

Mullaney, Howard Joseph, New York City. (Age 21.) Refers to R. E. Goodwin, F. O. X. McLoughlin, J. C. Rathbun.

Murray, Everett Webb, Kansas City, Mo. (Age 21.) Refers to A. L. Hyde, E. B. Murray, H. K. Rubey.

Nagel, Henry Peter, 3d, Denver, Colo. (Age 22.) Refers to E. O. Bergman, R. L. Downing, C. L. Eckel, E. W. Raeder.

Nawrocki, William John, Jersey City, N.J. (Age 22.) Refers to T. Saville, D. S. Trowbridge.

Neely, William James, Hastings-on-Hudson, N.Y. (Age 23.) Refers to C. T. Schwarze, D. S. Trowbridge.

Nichols, Paul Lewis, Reno, Nev. (Age 23.) Draftsman, Bridge Dept., State Highway Dept., Carson City, Nev. Refers to F. L. Bixby, H. P. Boardman, G. W. Malone.

Nicholson, Arthur Joseph, New York City. (Age 22.) Refers to J. J. Costa, A. V. Sheridan.

Peterson, Dean Freeman, Jr., Fillmore, Utah. (Age 22.) Jun. Engr., Utah Works Progress Administration. Refers to L. W. Clark, G. D. Clyde, H. B. Compton, O. W. Israelsen, H. R. Kepner, T. R. Lawson, R. B. West, E. R. Wiseman.

Post, Carl Arthur, Ames, Iowa. (Age 22.) Refers to R. A. Caughey, A. H. Fuller, W. E. Galligan, L. O. Stewart.

Powell, Fred Jackson, Flushing, N.Y. (Age 29.) Partner with A. U. Whitson, Civ. Engr. and City Surveyor. Refers to H. K. Endemann, L. M. Schoonmaker, H. B. Seaman, B. Weiss, A. U. Whitson.

Pratt, Willis Grover, Augusta, Me. (Age 25.) With Bridge Div., State Highway Comm. Augusta, Me. Refers to H. L. Doten, E. H. Sprague.

Rawstrom, Frederick Joseph, Savannah, Ga. (Age 22.) Draftsman, Central of Georgia R. R. Refers to R. P. Black, C. D. Gibson, F. C. Snow.

Richards, Frederick Tracy, Lawrenceville, N.J. (Age 21.) Refers to G. E. Beggs, F. H. Constant, P. Kissam, E. K. Timby.

Rippstein, John, New York City. (Age 33.) Field Inspector, U. S. Coast and Geodetic Survey. Refers to W. D. Ayers, R. E. Goodwin, W. H. Halsey, T. Human, Jr., R. Stephenson, C. R. Weaver, E. W. Wolf.

Rolette, Romeo, Brooklyn, N.Y. (Age 27.) Refers to T. Saville, C. T. Schwarze.

Russell, Howard Arthur, Berkeley, Calif. (Age 23.) Civ. Engr., Soule Steele Co., San Francisco, Calif. Refers to E. L. Grant, A. S. Niles, L. B. Reynolds, A. L. Trowbridge, J. B. Wells.

Sackett, Guy Woodford, Jr., Jackson Heights, N.Y. (Age 21.) Refers to R. P. Black, M. I. Killmer.

Samppala, Leonard Johann, Germfask, Mich. (Age 28.) Jun. Civ. Engr., U. S. Dept. of Agriculture Biographical Survey. Refers to C. L. Allen, C. M. Cade, C. A. Miller, L. J. Rothgery.

Schenkelbach, Abraham, New York City. (Age 22.) Refers to R. E. Goodwin, F. O. X. McLoughlin.

Shafer, Ira Roy, Mt. Union, Pa. (Age 25.) Refers to H. L. Bowman, S. J. Leonard.

Shriver, Karl Henry, Pittsburgh, Pa. (Age 49.) With U. S. Engr. Dept. Refers to N. W. Bowden, W. H. Frick, H. R. Hortenstine, W. L. Kuehnle, P. A. Perrin, J. T. Whitney.

Simon, William John, Los Angeles, Calif. (Age 26.) Refers to N. M. Imbertson, S. B. S. Nelson, R. R. Proctor, K. Q. Volk, W. W. Wyckoff.

Smallshaw, James, Murphy, N.C. (Age 31.) Asst. Hydr. Engr., TVA. Refers to A. S. Fry, R. E. Hutchins, W. T. Ivey, C. James, B. E. Morriss, H. V. Pittman, W. E. Sanford.

Solomon, Charles Edward, Springfield, Ill. (Age 23.) Jun. Highway Engr., Grade VIII, State Div. of Highways, Dist. No. 6, Dept. of Design. Refers to H. Cross, W. C. Huntington, W. A. Oliver, T. C. Shedd, F. W. Stubbs, Jr.

Spohn, Arthur Edward, Montclair, N.J. (Age 23.) Refers to R. P. Black, F. C. Snow.

Story, Jesse Willis, Franklinton, La. (Age 23.) Jun. Instrumentman, Louisiana Highway Comm. Refers to N. E. Lant, B. W. Pegues.

Sylvester, Gaftano Charles, Brooklyn, N.Y. (Age 25.) Refers to J. J. Costa, A. V. Sheridan.

Tantillo, John Anthony, Brooklyn, N.Y. (Age 23.) Refers to T. Saville, C. T. Schwarze, D. S. Trowbridge, S. F. Yasines.

Thompson, Charles Sumner, Jr., Compton, Calif. (Age 23.) Instrumentman, Pacific Elec. Ry., Los Angeles, Calif. Refers to A. L. Ferver, R. R. Martel, W. W. Michael, F. Thomas.

Thornton, Charles Victor, Youngstown, Ohio. (Age 20.) Steel Detailer, Truscon Steel Co. Refers to F. M. Allen, R. B. Ketchum.

Tourek, James Charles, Cicero, Ill. (Age 24.) Refers to H. Cross, J. J. Doland, W. C. Huntington.

Treadwell, William Frank, New York City. (Age 21.) Refers to J. J. Costa, W. M. Husson.

Tyler, Jack Hennigan, Canoga Park, Calif. (Age 23.) Laboratory Asst., Los Angeles County Flood Control Dist. Refers to R. E. Davis, C. Derleth, Jr., B. A. Etcheverry, F. O. Fricker, N. M. Imbertson.

Van Gelder, Spencer Henry, San Francisco, Calif. (Age 36.) Field Engr., A. C. Horner-Timber Eng. Co. Refers to A. V. Bowhay, M. J. Callaghan, T. C. Combs, A. P. Fisher, A. C. Horner, E. R. Huber, H. R. Trevor.

Van Wagenen, Oscar ver Nooy, Kingston, N.Y. (Age 26.) Refers to E. R. Cary, L. W. Clark, T. R. Lawson, W. W. Rousseau, H. O. Sharp.

Vickery, Glenn Orville, Tallahassee, Fla. (Age 25.) With Florida State Road Dept. Refers to R. P. Black, F. C. Snow.

Wagner, Edward Platt, Flushing, N.Y. (Age 23.) Refers to H. N. Lendall, A. J. Provost, Jr., E. L. Wagner.

Watson, Joseph Sherwood, Columbus, Ohio (Age 51.) Asst. Engr., Sewer Dept., City of Columbus. Refers to O. Bonney, H. M. Boyajohn, P. M. Holmes, R. B. Jennings, A. R. Lord, C. A. Raymond.

Westra, George David, Elmira, N.Y. (Age 30.) Engr., Elmira Light, Heat & Power Corporation. Refers to A. W. French, A. J. Knight, R. T. Lewis, H. W. Preston, J. E. Wadsworth, G. J. Watson, M. W. Wipfler.

Williams, Sam S., Philadelphia, Pa. (Age 23.) Refers to C. G. Dunnells, F. J. Evans, F. M. McCullough, C. B. Stanton, H. A. Thomas.

Witzig, Berard John, New York City. (Age 23.) Refers to J. J. Costa, A. V. Sheridan.

Wood, John Dudley, Blacksbury, Va. (Age 20.) Refers to R. B. H. Begg, F. J. Sette.

FOR TRANSFR

FROM THE GRADE OF ASSOCIATE MEMBER

Lane, Dwight Arnold, Assoc. M., Los Angeles, Calif. (Elected Dec. 15, 1924.) (Age 39.) With Bureau of Water-Works and Supply. Refers to H. F. Blaney, W. W. Hurlbut, C. H. Lee, J. B. Lippincott, A. E. Sedgwick, A. L. Sonderegger, H. A. Van Norman.

McEntire, Lloyd, Assoc. M., Saylorsburg, Pa. (Elected Junior Sept. 2, 1914; Assoc. M. May 31, 1916.) (Age 48.) Civ. Engr., Saylorsburg, Pa. Refers to J. D'Esposito, A. Hirst, C. A. Mead, R. A. Meeker, A. H. Nelson, G. F. Pawling, E. M. Vail.

Snyder, Morris Kay, Assoc. M., Pullman, Wash. (Elected June 6, 1927.) (Age 60.) Prof. of San. Eng. and Head, Dept. of Civ. Eng., State Coll. of Washington; also Consultant; Member, Board of Examiners for Professional Engineers License, State of Washington. Refers to O. A. Abelson, A. D. Butler, W. P. Hughes, T. H. Judd, W. A. Kunigk, C. Myers, H. E. Phelps, H. A. Sewell, A. J. Turner.

From the Grade of Junior

Babb, Arnold Obed, Jun. Grafton, W.Va. (Elected Oct. 14, 1930.) (Age 28.) Asst. Engr., Frederick Snare Corporation, Tygart River Dam, Grafton, W.Va. Refers to J. P. Blundon, J. B. Hoke, H. F. Peckworth, B. H. Simpson, M. W. Smith, Jr., C. Swecker.

Beinhauer, Frank Hugh, Jun., Des Moines, Iowa. (Elected Dec. 3, 1928.) (Age 29.) Asst. Res. Engr. Inspector and Relief Engr. Inspector, PWA. Refers to H. Cross, P. F. Hopkins, W. C. Huntington, A. E. Lindau, F. R. McMillan, G. P. Stowitts, C. C. Wiley.

Bogart, John Alleyne Calhoun, Jun., Tampa, Fla. (Elected Oct. 26, 1931.) (Age 31.) San. Engr., ERA, Key West, Fla. Refers to C. C. Brown, W. W. Fineren, J. G. Moore, A. F. Perry, Jr., P. L. Reed, W. E. Robinson, W. L. Sawyer.

Browder, Edward Marion, Jr., Jun., Balboa Heights, Canal Zone. (Elected Dec. 5, 1927.) (Age 29.) Structural Draftsman, Dept. of Operation and Maintenance, The Panama Canal. Refers to M. R. Alexander, A. L. Hertz, A. Jones, R. R. Martel, W. W. Michael, L. B. Moore, F. E. Powell, F. Thomas, T. B. Waddell.

Buchanan, Jesse Everett, Jun., Moscow, Idaho. (Elected Nov. 14, 1927.) (Age 31.) Asst. Prof., of Civ. Eng., Univ. of Idaho; also Testing Engr., Idaho Bureau of Highways. Refers to I. N. Carter, I. C. Crawford, T. H. Judd, G. H. Miller, C. R. Moore, J. V. Otter.

Holgren, Philip Grant, Jun., Spokane, Wash. (Elected March 10, 1930.) (Age 32.) Inventory and Appraisal Engr., Washington Water Power Co. Refers to A. I. Buchecker, A. D. Butler, E. H. Collins, T. H. Judd, W. F. McDonald, R. J. Middleton, A. J. Turner.

Keene, Philip, Jun., Washington, D.C. (Elected Oct. 14, 1929.) (Age 32.) Senior Tech. Clerk, Inspection Div., PWA. Refers to F. O. Dufour, H. M. Hale, T. R. Kendall, R. Ridgway, R. R. Rumery, J. F. Sanborn.

Kelly, Thomas Alfred, Jr., Jun., Golden, Colo. (Elected Oct. 14, 1930.) (Age 32.) Prof. of Civ. Eng., Colorado School of Mines. Refers to P. S. Bailey, L. F. Copeland, C. L. Eckel, J. C. Fitterer, H. J. Gilkey, W. C. Huntington, J. J. Richey.

Larson, Roy Edwin, Jun., Brooklyn, N.Y. (Elected March 15, 1926.) (Age 32.) With James Stewart & Co., Inc., New York City. Refers to R. E. Carrick, A. Fischer, Jr., V. McLean, C. E. Rauh, Jr., M. Sagal.

McMorris, William Barnhart, Jun., Harrisburg, Pa. (Elected Oct. 12, 1925.) (Age 32.) Member of Research Staff, Pennsylvania State Planning Board. Refers to W. E. Bailey, G. S. Beal, C. C. Chambers, J. S. Gena, E. S. Weed, H. R. Wertz.

Mannerow, Carl Edward, Jun., Bismarck, N.Dak. (Elected Oct. 1, 1928.) (Age 30.) Asst. Engr., North Dakota State Highway Dept. Refers to C. L. Allen, E. R. Griffin, C. Johnson, P. A. McLeod, S. M. Rudder.

Mundt, Kenneth Francis, Jun., San Francisco, Calif. (Elected Oct. 14, 1930.) (Age 29.) Civ. Engr., Standard Oil Co. of California. Refers to J. M. Evans, H. H. Hall, E. J. Nelson, G. Q. Thacker, S. K. Whipple.

Myers, Walter Dow, Jun., Baltimore, Md. (Elected March 5, 1928.) (Age 32.) Squad Boss with Pennsylvania Water & Power Co. and Safe Harbor Water Power Corporation. Refers to F. A. Allner, W. B. Carr, S. B. Downey, P. E. Gisiger, E. M. Graf, A. A. Meyer.

Perry, Wilbur Dow, Jun., Dallas, Tex. (Elected Feb. 24, 1931.) (Age 32.) Drainage Engr., Western Metal Mfg. Co. Refers to H. M. Chadwick, A. G. Classen, C. S. Henning, Jr., M. C. Nichols, A. P. Rollins, J. G. Rollins, W. J. Van London.

Punyagupta, Soonchong Boon, Jun., Bangkok, Siam. (Elected Oct. 1, 1926.) (Age 31.) Engr. in charge of Tech. Office, Royal State Railways of Siam. Refers to T. M. Bhiromya, C. B. Breed, C. M. Spofford, P. Sukhum, C. H. Sutherland.

Randig, Wesley Herbert, Jun., Cavite, Philippine Islands. (Elected Oct. 26, 1931.) (Age 32.) Asst. to Public Works Officer, being Yard Maintenance Supt., Navy Yard. Refers to L. W. Clark, L. B. Combs, E. B. Keating, T. R. Lawson, E. E. Lochridge, F. C. Nyland, N. M. Smith.

Renz, Carl Fred, Jun., Alhambra, Calif. (Elected Dec. 15, 1924.) (Age 32.) Asst. Testing Engr., Los Angeles County Flood Control Dist., Los Angeles, Calif. Refers to A. P. Banta, R. W. Carlson, K. J. Harrison, C. L. Randolph, F. Thomas.

Rodriguez y Catarroja, Filemon, Jun., Manila, Philippine Islands. (Elected Nov. 23, 1931.) (Age 31.) Tech. Asst. to Secy. of Public Works and Communications; also Prof., Mapua Inst. of Technology. Refers to A. Bolinas, E. W. Lane, H. R. McBirney, E. Mead. (Applies in accordance with Sec. 1, Art. I of the By-Laws.)

Santos, Adolpho, Jr., Jun., Sao Paulo, Brazil. (Elected Nov. 15, 1926.) (Age 32.) Asst. Hydr. Engr., The Sao Paulo Tramway, Light & Power Co., Ltd., New Constr. Dept. Refers to A. W. K. Billings, W. Charnley, C. P. Conrad, J. G. Hollman, C. Z. Overstreet, W. L. Zeigler.

Shockley, Dale Robert, Jun., Fort Wingate, N.Mex. (Elected Dec. 16, 1929.) (Age 29.) Asst. Agri. Engr., Dept. of Agriculture, Soil Conservation Service, Ft. Wingate, N.Mex. Refers to E. R. Diehl, G. P. T. Howell, H. C. Neuffer, C. H. Rightmire, E. R. Stapley.

Shockley, Dell George, Jun., Peach Springs, Ariz. (Elected Nov. 11, 1929.) (Age 29.) Project Mgr., Hualapai Indian Reservation. Refers to M. D. Glessner, F. D. Hartford, C. A. Hoglund, J. E. Kirkham, C. H. Rightmire, E. R. Stapley.

Smith, Willie Wade, Jun., Clarendon, Va. (Elected March 30, 1931.) (Age 33.) Asst. Structural Engr., Bureau of Yards & Docks, U. S. Navy, Washington, D.C. Refers to W. H. Allen, A. Amirikian, N. W. Dougherty, B. Moreell, E. C. Seibert, W. H. Smith, D. C. Webb.

Thee, Theodore Claude, Jun., Silver Spring, Md. (Elected April 23, 1928.) (Age 30.) Associate Highway Engr., Middle West Div. of Maintenance, U. S. Bureau of Public Roads, headquarters Washington, D.C. Refers to T. W. Allen, W. V. Buck, L. I. Hewes, W. C. McNown, F. A. Russell, C. Shoemaker.

Wegweiser, Jacob, Jun., New York City. (Elected Oct. 14, 1930.) (Age 28.) Asst. Engr., Mason & Hanger Co., Inc., New York City. Refers to B. F. Biemann, A. Haring, M. I. Killmer, H. L. King, C. T. Schwarze.

Wolfe, Joseph Marion, Jun., Tuscumbia, Ala. (Elected Dec. 3, 1926.) (Age 28.) Draftsman and Computer, TVA, Elec. Dept. Refers to C. A. Baughman, J. A. C. Callan, T. B. Chambers, L. Evans, P. B. Hill, H. O. Robison, S. R. Young.

The Board of Direction will consider the applications in this list not less than thirty days after the date of issue.

Men Available

These items are from information furnished by the Engineering Societies Employment Service, with offices in Chicago, New York, and San Francisco. The service is available to all members of the contributing societies. A complete statement of the procedure, the location of offices, and the fee is to be found on page 87 of the 1935 Year Book of the Society. To expedite publication, notices should be sent direct to the Employment Service, 31 West 39th Street, New York, N.Y. Employers should address replies to the key number, care of the New York Office, unless the word Chicago or San Francisco follows the key number, when it should be sent to the office designated.

Construction

Materials Engineer or Concrete Technician; Assoc. M. Am. Soc. C.E.; Member of American Society for Testing Materials and of American Concrete Institute; technical education; 10 years on construction, 6 of them in charge of testing construction materials. Experienced particularly in supervising concrete tests and investigations and in preparing reports; several papers published. C-8022

Construction, Civil Engineer; Assoc. M. Am. Soc. C.E., Wisconsin state license; university graduate; 12 years experience on road, bridges, walls, etc., cost reports, surveying, office work, subdivision, supervision, and inspection. Salary or location no object if there is possibility of advancement and some degree of permanency. Available immediately. C-6632.

Graduate Civil Engineer; Assoc. M. Am. Soc. C.E.; professional engineer's license in New York State; age 35; 10 years experience on roads and pavements, concrete bridges, and electric lines. Office work on checking designs and estimates of all types of construction. Good knowledge of economics, finance, and statistics. D-3997.

Construction, Office, and Valuation Engineer; Assoc. M. Am. Soc. C.E.; age 40; B.S. in civil engineering; 15 years experience in railroad and bridge construction and valuation, railroad location, line and grade revision, bridge, trestle, and culvert construction, and reporting same as required by Interstate Commerce Commission; 11 years in responsible charge. Southeast preferred. D-4034.

Draftsmen

Draftsman; Jun. Am. Soc. C.E.; age 28; single; $3^1/_2$ years experience in design and construction of sewers and their appurtenances; 2 years experience in making maps and quantity estimates for river dredging. (Maps made from aerial photographs.) Location and salary secondary. Can give excellent references. Available immediately. D-3919.

Draftsman, Surveyor; Jun. Am. Soc. C.E.; 29; married; 3 years Rensselaer Polytechnic Institute; 1 year New York University. Experience: 3 years structural steel detailing on bridges and other railroad structures; 15 months surveying and construction work in field; 6 months plant layout, equipment, heating; 15 months estimating, computing. References. Available immediately. D-4295.

Executive

Civil Engineer; M. Am. Soc. C.E.; 48; married; 20 years experience in design, location, and construction of highways, bridges, wharves, airports, drainage systems; 10 years in responsible charge of $13,000,000 construction program. Desires connection with industrial or utility corporation where business training and technical knowledge are essential. D-4312.

Structural Engineer and Designer; 42; widower; 20 years experience in details, design, and construction, steel buildings and bridges, also reinforced concrete. Plant layout and design. C.E. graduate. D-1028.

Graduate Civil Engineering; Assoc. M. Am. Soc. C.E.; registered in two states; 13 years experience; desirous of making connections; 4 years supervision and construction of concrete highways and bridges; 5 years in charge of preliminary surveys and plans for municipal improvements; 4 years as construction engineer on large industrial plants, installation of equipment, and preliminary operations. D-1100.

Graduate Structural Engineer; M. Am. Soc. C.E.; New York, Illinois, and California license; 20 years with present associates. Structural designer, estimator, and supervising engineer in charge of designing and drafting offices on industrial plants and facilities; railway shops and terminal structures; power houses and substations; special structures. Available anywhere on short notice. D-4320.

Civil Engineer; M. Am. Soc. C.E.; 42; married; 25 years industrial work (bakeries, packing houses, etc.) as office manager, purchasing agent, general superintendent. Desires similar post with architectural engineer, industrial corporation, or as superintendent of public works or buildings in municipality of 100,000. Eastern seaboard. Would go to England or Canada (connections in both) as sales representative. D-932.

Executive; M. Am. Soc. C.E.; consulting civil engineer; 55; married; A.B. and M.C.E.; 36 years experience; qualified for responsible supervision and management; private or public work; familiar with all types and phases of engineering activity; accustomed to handling special unique problems requiring large personnel; free for engagements; location, West Coast. A-2394.

Graduate Civil Engineer; Assoc. M. Am. Soc. C.E.; Massachusetts Institute of Technology, 1908; 25 years experience on design of steel and concrete structures and as resident engineer on construction for iron and steel industry. Thoroughly competent to direct design or to supervise construction in the field. Exceptional references. At present employed. B-5607.

Engineer Executive; M. Am. Soc. C.E.; Pennsylvania professional license; connected with steel fabricating business as well as general contracting for past 25 years in various capacities, particularly in engineering supervision, plant management, and sales promotion. Hit by depression. Desires a connection with opportunity. C-5095.

Patent Attorney; Assoc. M. Am. Soc. C.E.; registered patent attorney, who is a graduate engineer and member of Bar, desires to make change, preferably by forming connection with a corporation to organize and manage its patent department. Has had several years experience with an outstanding patent law firm. Has had three years experience with corporation patent departments. B-1819.

Structural Engineer; Assoc. M. Am. Soc. C.E.; C.E. graduate, 1923; registered engineer in Pennsylvania; 37; bachelor. Experience in detailing and design of structural steel, bridges, and mill buildings, riveted and welded. Some surveying. Experience on maintenance force. Also heating, ventilating, and sanitary engineering. Available short notice. Will go anywhere. D-4329.

Engineer; M. Am. Soc. C.E.; 38; C.E., N.Y. State P. E. License. Design and construction of industrial or metallurgical plants. B-5715

Junior

Civil Engineer; Jun. Am. Soc. C.E.; age 25; single; C.E., Columbia University, 1934; good references; 1 year experience with the U. S. Coast and Geodetic Survey. Keenly anxious to be employed with some well-established industry or private concern. Location immaterial. Available immediately. D-4238.

Civil Engineer; Jun. Am. Soc. C.E.; 24; single; B.S. in C.E. degree; 4 months experience surveying, instrumentman; desires opportunity in any branch of engineering. Willing worker. Location anywhere. D-4267.

Civil Engineer; Jun. Am. Soc. C.E.; 23; married; B.S. and M.S. in C.E., University of Colorado; graduate work in hydraulics and structures; 6 months experience as instructor; 6 months as instrumentman, U. S. Coast and Geodetic Survey; 1 year with the U. S. Bureau of Public Roads. Desires opportunity in any branch of civil engineering; prefers design or construction. Location immaterial. Available. D-4282.

Civil Engineer; Jun. Am. Soc. C.E.; B.S. in C.E., New York University, 1934. Desires any position in civil engineering field within the United States, with the East preferred. Good college record; speaks Italian. Salary secondary. D-2992.

Civil Engineer; Jun. Am. Soc. C.E.; 29; married; B.S. in C.E., Drexel Institute, 1932; 15 months railroad drafting room (survey, design, layout of commercial sidings); 1 year inspector on foundations and catenary (railroad electrification). Desires opportunity in any branch of civil engineering. Location secondary. D-4097.

Engineer; Jun. Am. Soc. C.E.; recent graduate, B.S. in C.E., Cooper Union Night School. Desires position in any field of civil engineering. Experienced in all forms of clerical work. Salary secondary. Preferably in New York City. D-3518.